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Extracts from Chordal's Letters.

Mr. Editor:—

* * * * Carr had his mill work done by Wyckoff. Lots of inch and three quarter and two inch shafting, lots of pulleys, lots of spur and bevel gears, lots of gudgeons, and lots of babbitted boxes. Such is the character of most orders for mill gearing. There were probably thirty pieces of two inch shafting, short and long. By two inch shafting I mean two inch iron turned down a sixteenth, and there were probably fifty pulleys to go on these shafts, many of the pulleys the same size. I watched Wyckoff's foreman giving orders in the shop while this work was being done. He would go to Joe with a piece of iron about a yard long, and say: "Turn this up to fit that pulley and that bevel wheel, and turn a journal on each end so we can babbitt those boxes on them." Joe went at it but ran against a snag the first thing. The pulley and the bevel gear had not been bored the same size. Joe tells the foreman so. Foreman says: "Its strange, I told Charley to bore it to one and fifteen sixteenths." Joe says he can't help that; that pulley won't go on any shaft which the bevel gear will fit. Foreman takes the calipers and investigates. Yes! that's so. Well you fit this shaft to the bevel, and I'll have Gus *file* the pulley out.

* * * * He does have it filed out, and he has something of the kind filed out every day the shop runs. Furthermore, about every hole bored in the shop is tapering, and furthermore, his one and fifteen sixteenths don't mean anything. Charley does his best, sets his calipers as close as he can to that size, but bless him, he can't set them the same size to-morrow. If he bores a pulley one and fifteen sixteenths every day he will have six different sized holes Saturday night. This is the best Charley or any other lathesman can do. The fault is Wyckoff's, as we will see presently. The foreman knows the Monday and Tuesday sizes are not the same, and he is smart enough to have the hole around for the shaft man to measure when he fits a shaft.

* * * * Carr comes into Wyckoff's office in a few months and orders a fourteen inch pulley to go on the long two inch shaft down at the mill. Wyckoff says he must send a man down to get the size of the shaft. Carr says, "Why; you made the shaft yourself. Bore the pulley to fit your two inch shafting and it will be all right." Wyckoff says, "It wont be all right; for no two pieces of my two inch shafting are the same size." Carr says they ought to be, and wonders what will happen if he wants to transpose anything around the mill. Wyckoff tells him he can't do it; tells him if he left his mill and worked at the machine business thirty years he would find out that machinists never measured alike, and that every pulley must be fitted to where it belongs. Carr is bold enough to think there ought to be some way to keep things decently uniform, and Wyckoff is ignorant enough to say there is no way in which it can be done.

* * * * There are a lot of nice machine men in the country who will congratulate us on there being but one Wyckoff. There's where they make their mistake. Wyckoff is ubiquitous; he outvotes finer owners, he "raises" the most mechanics, he does most of the work.

* * * * Carr's old mill gearing was made by Sackett. Carr never happened to know it, but any two-inch shaft in the mill would fit any two-inch pulley, and if a short two inch shaft has shouldered journals, those journals will fit any similar boxes in the mill. Carr can go to Sackett's in three years from now and order a box, or a pulley, or a shaft, and the only size wanted is the nominal diameter.

* * * * There is no shouldered shaft in Carr's new mill which will allow itself to be turned end for end. The journals are not the same diameter on each end. Every babbit box is run on the shaft it is intended for. Sackett's boxes are run on shafts kept in the shop for that special purpose. They are always uniform. His pulleys he reams out, but he did just as good work before he got his reamers, but it cost him a great deal more money. Why? Because it took a more expensive man more time to do the work.

* * * * Dix and I both worked for Wyckoff at the same time, "many years ago"—the same Dix, by the way, Mr. Editor, who, it appears, from one of your late issues, is offering up prayers for Chordal. We tried to get Wyckoff to do something to keep sizes uniform. We were simply journeymen, but we claimed some sense. We were working as closely as we could, and as close as any other workmen in the world could, I guess. That is, we set calipers to marks on scales and turned to the calipers. The mortal don't live who could keep sizes uniform with these facilities, and this is all a workman is supposed to have.

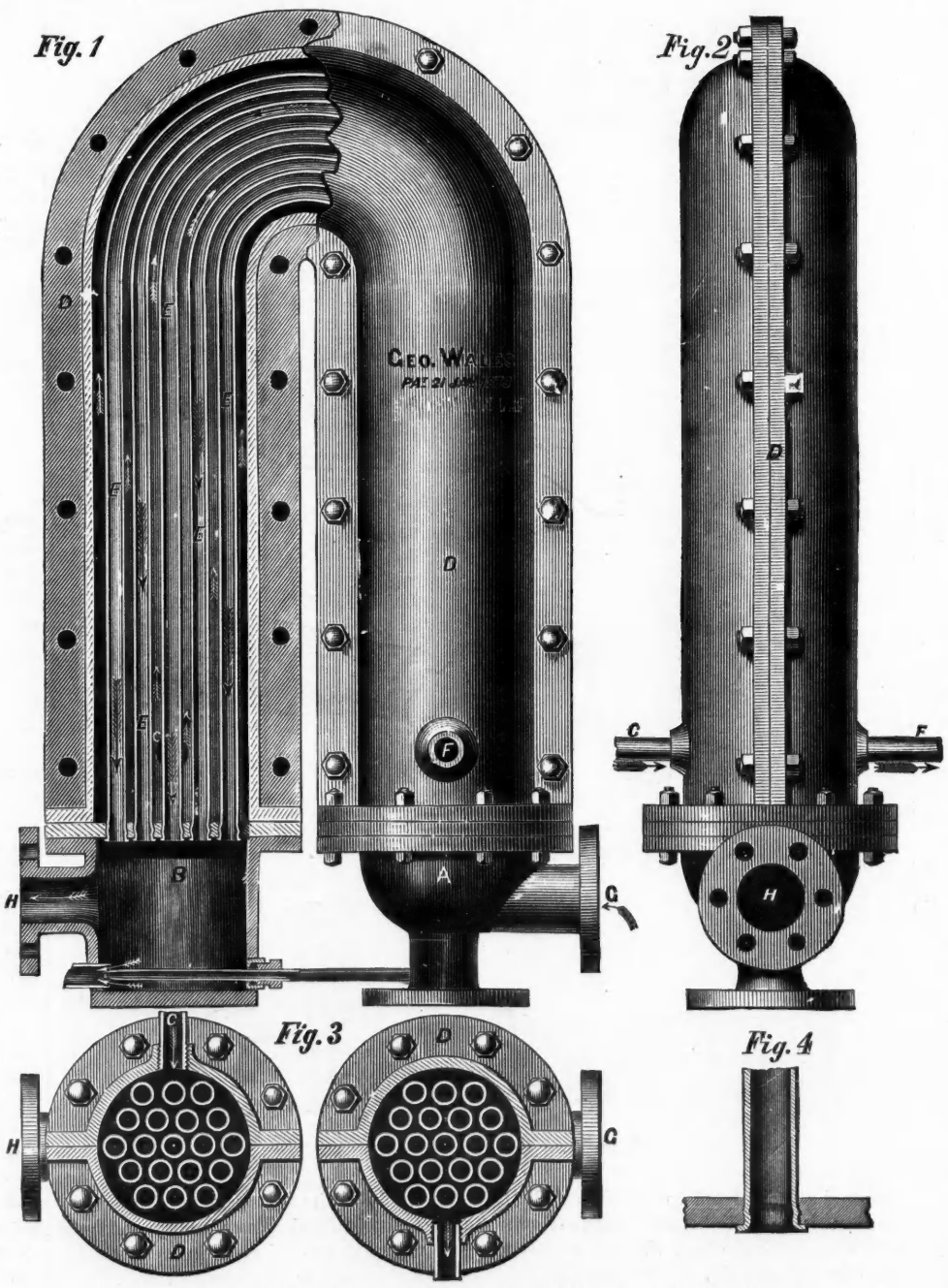
We knew if we had some better way of getting a size than by picking it off of a scale, we could do more satisfactory work, and by "satisfactory" we meant better work and more of it. We wanted some record, some monument, some standard of sizes. Something we could copy every time. Wyckoff didn't know of any such thing; and more than that, he didn't care. He had for thirty years, etc. But Dix and I did care. We decided that if Wyckoff would not have good standard sizes, he should have bad standard sizes—some standard we *would* have. We two held a meeting, and on motion it was resolved that we would watch our chances and steal the time and bore out collars, to one and seven-sixteenths, one and eleven-sixteenths, one and fifteen-sixteenths, and two and three-sixteenths. These collars we would bore as nicely and to as accurate a size as we knew how. These collars we would hide away somewhere, and when we or the other boys wanted a size, we would set inside calipers to these holes, and for shaft work we would try the collars on. We chose on the sizes named because they were the sizes in most common use in the shop.

Well, we made the collars and piled them nicely in a cupboard. We used them all the time, and the other men appreciated the thing. But, one day, a collar was gone, and soon another was gone. When we came to snort around some, we found Wyckoff had found them, and supposed they were simply extra collars; so he had used two of them—had had them set-screwed and sent out with work. Our collars were simply common cast iron collars, mind you.

We held another meeting, and, as a result, we invented a collar-which-Wyckoff-couldn't-get-a-set-screw-into. We replaced the two lost ones and turned a deep groove in each; that is, we run down with a cutting-off tool till the collar was nearly cut in two. No man on earth could get a half-inch set-screw into such collars, for they were only about an inch-and-a-half wide, anyhow, and the cut came right in the middle.

* * * * Just here, Mr. Editor, let me mention the collars made by Lane & Bodley. They are common set-screwed slip collars for shafting, but the plan for keeping the set screw from projecting is good. It consists in leaving a ring, or band, around the middle of the collar, the band being about seven eighths wide, and say half an inch high. The band does not go all the way round, but has a short gap in it. The set screw is placed at this gap, and its head don't project above the band. The collars don't look pretty, but they look less wicked than the common ones.

* * * Well, to return to our scheme. Our collars worked very well. We soon added short wrought iron plugs, which fit the collars nicely. These plugs we could try in holes. We used calipers, just as usual, but we tested everything by these plugs and rings. Soon we actually had a set of mandrels, which we could go and get, and know they would fit a job without being fooled with. Soon we found we couldn't go and get them, because somebody else had gone and turned them down to fit something else. We never were able to contrive any plan or plot by which we could keep these mandrels. Remember, Mr. Editor, Dix and I were jours., not bosses or owners. Had we been bosses, there would have been bloodshed in Wyckoff's shop. For a whole long year, Wyckoff's work of these sizes was uniform, and there was no fussing over sizes, and



WALES' FEED-WATER HEATER AND PURIFIER (SEE PAGE 2).

many, and many, and many an hour's time was saved to the shop. If we could have mastered the mandrel problem, we would have been the means of saving Wyckoff hundreds of dollars a year.

* * * * Our fancy gauges had their demerits. They would wear out of size. They were heavy and clumsy. The collars could not be got on work without loosing the job, and even then they would not go up close to a tool. If a shaft began to work large, the collar could not be got over the big place so as to try new parts. They were not what we wanted, but they beat "nothing" all to pieces. Dix struck the keynote when he said we never ought to use the gauges at all, except to set calipers by. Then the gauges would never wear out, and we would still have just as uniform sizes.

* * * * We debated on the question of letting Wyckoff into the thing. He had several times expressed wonder at a piece fitting in two or three places, and had remarked at our luck in picking up a mandrel which would fit a job. Dix opposed exposure—said the inelastic Wyckoff would snub the idea of there being better ways of doing things; that he had for thirty years, &c. We never did tell him. We, one day, left Mr. W.'s shop, and, since that, it has been the good fortune of both Dix and myself to have a hand in regulating things—in putting into practical use those sundry little rigs which count in economy. We have found out how poor our sly standards really were, and we have found that there are much better ways of doing the thing. If nothing happens, Mr. Editor, I will make these "better ways" the subject of my next letter, and I will try and illustrate it with pictures, facts and figures.

* * * * When a shop contemplates getting a new thing, there is one infallible test to apply. Is the thing an element of economy? Will it reduce the cost of bad work? Will it improve bad work? Will it improve good work? Will it reduce the cost of good work? Will it save the parties money, work, reputation, or time? If all the answers are no, say we can't afford to get it. If *any* answer is yes, say we can't afford to do without it.

In ninety-nine machine shops in a hundred there are no provisions made for uniformity of sizes. Not even the poor rigs Dix and I got up on the sly. When a new tap is made it is not the size of the old one. Nothing can be uniform under such circumstances; nothing can be cheap. If you have a machine shop, Mr. Editor, or if you have any authority in a father-in-law's shop, study well into the subject of standard tools. Get decent workmen, pay them decent wages, give them decent facilities, expect decent work, and you can make a decent price list. Standard tools you can't afford to do without.

* * * * Very respectfully,

CHORDAL.

Wales' Feed-Water Heater and Purifier.

The heater shown in the engravings on first page is intended to utilize the waste, or exhaust steam, in heating water, with which to feed the boiler, and, for this purpose, evidently possesses a number of excellent qualities. It is also adapted for heating water for dyeing vats in woolen mills, print works, hotels, hospitals, colleges, bakeries, public buildings, and all places where pure water is important and necessary. By an arrangement of steam tubes, among which water passes, it is gradually heated, so that, when used, it is almost steam itself.

By making the water connections, *F* and *C*, larger, and moving the water with greater velocity, the heater may be employed as a surface condenser, and can be easily adapted to marine engines.

The U-shaped form of the tubes provides wholly and effectively against any destructive action through differential expansion. The heater may be placed horizontally, vertically, or in an inverted position from that shown, and is claimed to work equally well in any position. The heater is very compact, and is claimed to be constructed upon such principles as are essential to the highest efficiency.

Referring to the illustrations, Fig. 1 is an upright view, a portion of the outer case being removed in order to exhibit the internal arrangement. Fig. 2 is a side view, complete and ready to connect. Fig. 3 is a cross-sectional view, showing the inner position of the brass tubes. Fig. 4 shows the manner in which the tubes are inserted.

A is the steam chamber; *B* is the condensed-water chamber, with injector for carrying away condensation, leaving a *dry exhaust;* *C* is the induction pipe for water; *D* is the U-shaped case; *E*, the brass tubes for steam; *F*, eduction pipe for water; *G*, nozzle for the entrance of steam; and *H*, nozzle for the escape of the steam.

The heater consists of an inverted U-shaped pipe or casing, made in two parts, for the purpose of ready access to the tubes, to remedy defects, or to repair breakage. The two parts are joined by bolts and flange, as shown in Fig. 2. This casing contains a number of brass tubes of the same form, and equal in area to the exhaust pipes of the engine, and sufficient not to interfere with the exhaust, though, at the same time, affording sufficient surface to heat the water most effectively and quickly.

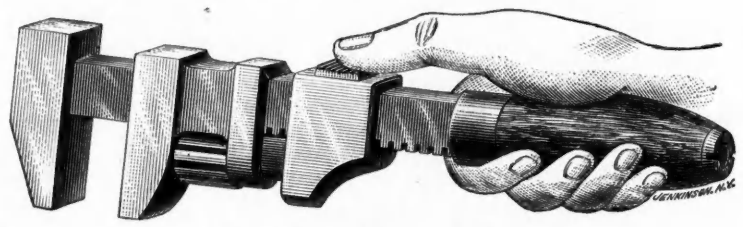
The heads are bolted in between the lower flange of the U-shaped casing, and the top flange of the connecting steam chambers, *A* and *B*. The water enters by the induction pipe *C* (seen *white* in Fig. 1 and *black* in Fig. 2), at the lower part of the case, and directly above the tube sheet over the chamber *B*. It passes slowly between the tubes *E* and the sides of the case, escaping by the eduction pipe *F*, near the base, and above the chamber *A*. (See Figs. 1 and 2.)

The steam is admitted into the chamber *A* through the nozzle *G* (see Fig. 1), passing into and through the brass tubes *E* in the direction of the arrows, escaping into the chamber *B*, at the opposite side (see Fig. 1) when it escapes through nozzle *H*, Figs. 1 and 2. By this arrangement the water enters at the *coolest part*, grows gradually hotter as it passes among the brass steam tubes, and escapes where the steam enters, or at the *hottest part of the case.* The steam and water flowing in opposite directions as shown by the arrows, is claimed to cause a perfect interchange of heat.

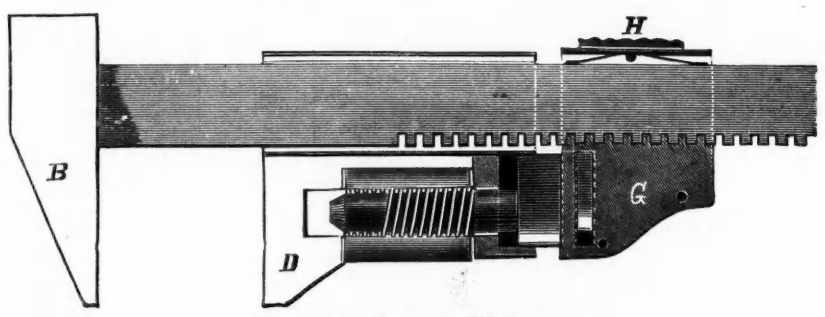
The velocity of the water is regulated by the difference between the outlet *F*, and the space between the tubes *E*. If the area be 50 times greater than the outlet, it is claimed the velocity of the water will be only 1-50th, and all the time it will be increasing in temperature, entering (as already shown) at the *coolest* and escaping at the *hottest part of the case.*

If deemed desirable, the action may be reversed by passing the water through the tubes and the steam through the surrounding interstices; the connections being suitably arranged, and the results will be substantially the same.

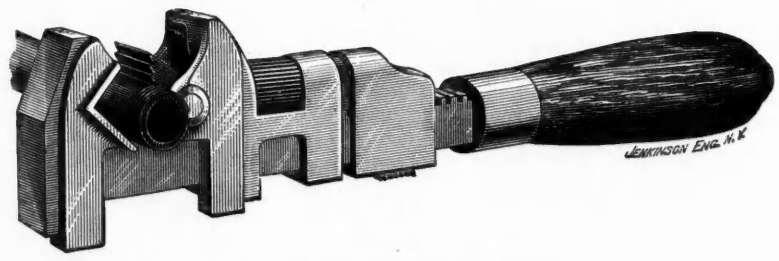
It is also claimed that the water when entering the boiler is within a few degrees of the boiling point. The heating area is said to be sufficient to always provide the necessary supply. The arrangement of tubes precludes any difficulty from sediment or expansion. The case of repairing or cleansing is too apparent to need explanation. The necessity of a feed-water heater is everywhere acknowledged. Thus far this heater seems to have met with a very favorable reception. It is furnished at a nominal cost and the expense of attaching it to any boiler is small and involves few changes. Further particulars may be obtained by addressing Wales' Feed-Water Heater Co., G. W. Dutcher, Manager, 95 & 97 Liberty street, N. Y.



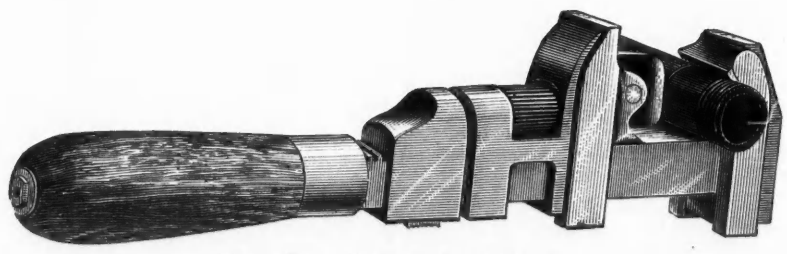
RAPID TRANSIT SCREW WRENCH,



SECTIONAL VIEW OF WRENCH.



WITH PIPE WRENCH ATTACHMENT.



WITH PIPE CUTTER ATTACHMENT.

Rapid Transit Screw Wrench and Attachments.

One of the novelties of interest to engineers and master mechanics is the Read & Beach Rapid Transit Wrench, with attachments, by which it may be instantly changed to a pipe wrench or pipe cutter, as shown in the accompanying cuts.

The first cut represents the wrench with the thumb upon the thumb piece ready for adjustment to any width.

The second cut is a sectional view, showing the construction and operation of the wrench.

B is the stationary jaws; D, sliding jaw; H, thumb piece, showing the spring between it and bar; G, toothed holding device.

The third cut shows the wrench, with pipe wrench attachments, in position.

The fourth cut shows the same, with pipe cutter attachments in position.

It is made of forged steel, and each class to a gauge, so that one set of attachments will fit any wrench of its class.

The special advantages claimed will be apparent on even a casual examination. It presents simplicity, strength and durability, is positive when set, and has little liability to get out of order. For ease and rapidity of adjustment it takes a high rank, it being only necessary to press the thumb on the thumb piece, and to slide the jaw to the proper width. If a closer fit is required, a slight turn of the thumb-nut will give any desired clamping power. The jaw, being held firmly by interlocking with the bar, by eight teeth, and all the working parts being made of tempered steel, cannot yield under the most severe strain. It is claimed that no amount of use can produce any back lash in the sliding jaw.

This wrench is now in use by many of the practical mechanics in different branches, all of whom strongly indorse all that is claimed for it.

For further information address H. F. Read & Co., 152 South 5th Avenue, New York.

Boiler Proportion and Construction.—The Locating of Tubes and Flues.

BY WILLIAM H. HOFFMAN, M. E.

At the finish of the last paper on boiler proportion and construction, I gave the reasons for the gradual loss of evaporative power due to the action of the *elements* under heat. This natural effect can only be overcome or neutralized by either chemical, galvanic, or electric combinations, or actions.

But there are methods of locating flues and tubes, or even fire-boxes and stays, in boilers, that cause more trouble, damage and expense than anything chargeable to elementary causes. The badly designed and proportioned boiler, clean or unclean, will seriously interfere with the generating of power, independent of all other conditions.

When tubes, or flues, are placed so near to each other, or to the shell of boiler, that they actually prevent circulation, and the separation of the steam and its free passage from the water, we have a mechanical difficulty before us insurmountable. The steam is *strangled* (a proper term, is it not, Mr. Editor?); and that is not all, for excessive priming is a "regular boarder" in a boiler like the above description.

I do not wish to make an unreasonable statement, but I really believe that two-thirds of the boilers in use to-day have their tubes and flues too near together—too many of them for the diameter of shell; tubes too small in diameter for their length where natural draught is depended on; while, in fire box, or internally fired boilers, the water spaces are not only too narrow, but it is utterly impossible to clean them.

We will look at the arrangement of tubes first. The diameter of horizontal tubular boiler shells, now-a-days, vary from 30″ to 96″, and the lengths run from 10 feet to 24 feet. The tubes used are from 2″ to 5″ outside diameter. The fire, of course, passes through the tubes.

A boiler with a 66″ diameter shell is generally 16 feet long, and contains about sixty-six (66) 3½″ tubes—too many tubes by *twelve*, and too long by 2 feet, for the best results. The diameter of tubes for the shell is all right.

It is not proper, by reason of natural causes governing the transit of heated volumes of gases, &c., to make tubes proportionate in length to their area. For example, a 5″ tube should *not* be double the length of a

3½″ tube simply because it is double the area of the small tube.

Experiments and observation have taught me that, in doubling the area of a tube, the advance in length can only be 50 per cent., with economy in view, so that a boiler with a shell 96″ and tubes 5″ diameter should be 21 feet long—no more, no less—for the best steaming duty. In all boilers, tube or flue style, the tubes or flues must *never* be nearer the bottom of shell than 10″, while the side rows of tubes should clear side of shell at least 4″ (I am now speaking of boilers over 48″ diameter). They cannot be cleaned unless this rule is observed.

In designing a 66″x14ft. tubular boiler 3½″ tubes, I place the lower course of tubes 13″ from the bottom of shell, and the side tubes 4½″ from shell. Tubes 1⅞″ apart measuring on a *vertical* line, and 1⅝″ apart measuring across the horizontal. The top course is entirely above the center of boiler; no steam drum, but a liberal-sized inside dry pipe, short, and placed near the front end of boiler; boiler inclines toward to the front 3″. A boiler constructed after the above design, properly set and mounted, will generate steam for an 80 H. P. engine without the slightest signs of priming, and there will be no more than *fifty-four* (54) tubes, and fifty-two (52) will give the power noted above; and the water can never be driven away from the bottom and sides. The tubes should never be staggered.

Some of the steam drums placed on steam boilers are certainly ludicrous in the extreme. They are not only useless in preventing priming, but they act as condensers, render the boiler weak from the mode of attaching them, and are ungainly and a nuisance in handling. As generally constructed, they are about as useful as an ordinary quart measure would be in their place. A boiler that has enough water and steam space in its shell requires no steam drum, and it never will prime, to a noticeable degree, unless sadly overworked.

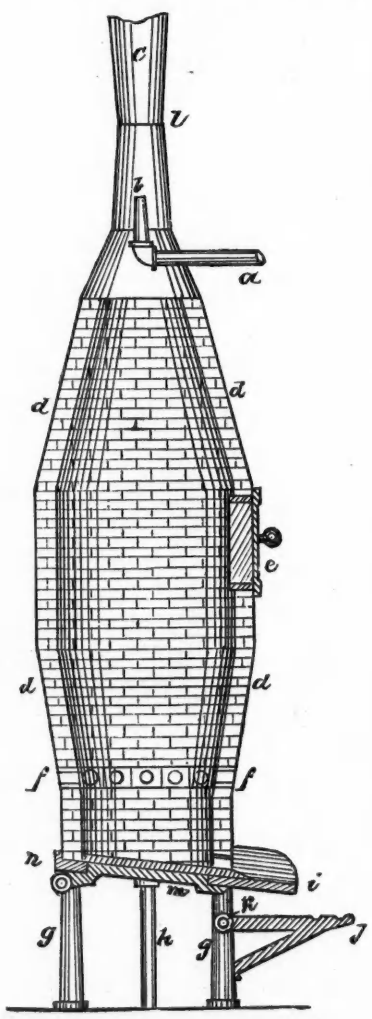
Priming is, I believe, caused, to a large extent, by a reduction of pressure and increased ebullition under that point of the boiler whence the steam is drawn. By this means, water is carried into the very top of steam drums, and I have seen cases where the inside of a drum would be plastered with mud two inches thick, and not a particle of it on the tubes, or inside of shell, except, perhaps, a little in the immediate locality of the drum. A steam drum cannot be protected or jacketed so as to prevent the reduction of temperature and pressure below that of the boiler shell proper.

Foundry Cupolas.

BY V. HOOK.

It occasionally becomes desirable to erect a small cupola by persons of limited means or by amateurs. The expense of a fan and an engine to drive it not infrequently forms the stumbling block. When this is the case, a cupola put up as shown in the sketch will give as satisfactory results, both as to amount of iron melted and time required, as one with a fan blast. There is, of course, an advantage in having an engine to drive a cleaning mill or "rumbler" to clean the castings and obtain the iron in the cinders. The blast in this plan is supplied by means of the pipe *a* and nozzle *b*. This pipe is attached to a boiler; a pressure of 20 lbs. will suffice. The force of the blast may be approximated by contracting the stack at *e*, or by the size of the nozzle *b;* the exact amount of blast necessary being controlled by a valve in pipe *a*. An old boiler—one that has been condemned for other purposes, will often answer, owing to the light pressure required. The amount of steam used will not vary from that required to supply same blast with engine and fan. The tuyeres, or air holes, *s s*, are furnished with sliding doors to regulate incoming air. The shell of the cupola may be an old boiler shell or it may be formed of cast-iron staves like a barrel, and banded. The shape shown in the engraving is not necessary, as parallel sides will give good results. The best form, however, is that shown in the sketch, to concentrate the heat. The shell is made of light boiler iron, riveted; this is supported on a cast-iron base *n*, which is furnished with a "bottom," or door *m*, hinged as shown. This door is supported by a wrought iron rod *h*. When the melt is completed, this rod *h* is tripped and the "bottom dropped," allowing the contents to fall through to the floor. The entire cupola is supported on four cast-iron pillars *g g*, the two front ones having brackets *j*, as shown, pivoted to them, with half round grooves to support the ladles. These brackets swing up out of the way when not in use. The charging door, *e*, must fit well to make the blast effective; *i* is the spout and *c* the stack. These cupolas are charged the same as the ordinary cupola and will melt about as fast. They will average about six or seven pounds of iron to the pound of coke.

The secret of "daubing" a cupola is not generally known. Most cupola tenders, after picking out the cupola, will daub on from one to three inches of clay on the lining, just over the tuyeres, where the most if not all of the melting is done. This "daubing," after drying, cracks, from the fierce heat suddenly applied, and falls off from its own weight,



Small Foundry Cupola.

exposing the brick lining. A few similar operations lay bare the shell when new bricks are put in. If the cupola tender will not daub on more than half an inch of clay, he will find that it will stay where put, and the brick lining last ten times as long. I remember a cupola that required new brick after every melt nearly, and a little experimenting revealed the above facts, when new bricks were the exception and not the rule. The tuyeres are sometimes in fault and a change in position and size will save the lining.

The manufacturing establishments of Peoria, Ill., are reported to be unusually busy. The iron foundries, machine shops and flour mills are unable to meet the demands of trade.

Lamp wicks of spun glass are made in Germany. They supply the petroleum, oil or spirit more regularly, and lamps which are provided with them can be carried about with less danger of going out, or scattering sparks and kindling conflagrations. For equal strength of flame, the glass wicks give a clearer and purer light; they have a less unpleasant odor; they consume less fuel; in spirit lamps they give a more intense heat, with a more quiet and steady flame.

Bits of Experience.

No. II.

BY JOHN E. SWEET.

I see Chordal has been on a pilgrimage to the East. We, who have fallen in love, so to speak, with his glowing shop pictures, regret his not stopping here on his way, to let us worship their author in person. * * *

What I wanted to say about the grindstone business was simply this: At Syracuse, if we have to hang a grindstone to a wood frame, we do not bolt boxes to the timbers at all, but turn a pair of short line shaft hangers bottom side up, as shown in Fig. 6, and bolt them to the timbers, put in boxes, which are hung in gimbals, precisely as Chordal has described in a late article; and the shaft can be put in and taken out, or adjusted, in one quarter of the time used by the rigid box system. Where a cast iron frame, or trough, is used, two horns are cast on, which take the place of the hanger, and so all the machine work required is simply that of drilling and tapping four holes. In the use of this kind of arrangement there is a great advantage over and above that of simply the cost of construction. A perfectly straight shaft, put in a grindstone, and fastened by the ordinary collar washers and nut, will not be straight after the nut is tightened, no matter whether the shaft is one inch or three inches in diameter. With a crooked shaft, any kind of a rigid box stands a poor chance, while, with the self-adjusting box, it makes but little difference. I am led to make this assertion because I notice the self-adjusting

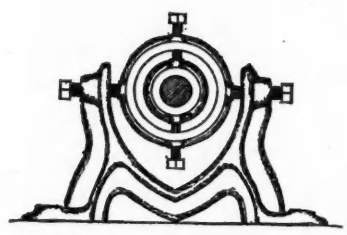


Fig 6.

boxes never—"well, hardly ever"—stand still; but, while the stones are running, they invariably move in a way that shows a crooked shaft. * * *

I want to endorse what Chordal has said about the superiority of line shaft hangers when the box is held in gimbals; not that it will add value to his statement, but a good thing will stand telling twice. The box, supported in a ring by two set screws, can be raised or lowered vertically, while the ring, supported in the hanger by two set screws coming in at the sides, can be adjusted horizontally. Whoever thinks that lining up a shaft, by driving over the hangers with a sledge, is a good way, probably never tried the monkey wrench and set screw plan. * * * Friend Hoffman thinks a detachable valve gear that will work up to 100 R desirable. We can show him three or four Corliss engines, varying in size from 16″x30″ to 20″x30″, running 120 revolutions per minute, and one, 12″x20″, running 150, and has been so running a year or more, and over 100 turns for 14 or 15 years. Two of the engines are of Mr. Corliss' own make, and parts of all are. It proves to be a question of a quick spring. The engines do not seem to suffer any more than they would making the same number of turns in twice the time. The one making 150 turns appears as if it was on the down-hill road to destruction, but keeps on going all the same. * *

Is not your correspondent who wants to be told how to proportion, draw the curves and make various kinds of gearing, in a short article, asking altogether too much? To describe a common thing or process in so plain and comprehensive a manner that one who knows but little of the subject will understand it, is not an easy thing to do; and this understanding a plain description when given is not a common faculty. Those having it have usually acquired it by degrees. In this matter a hint often enables one to master things that seem confusing at first sight, but are simple when once understood. The hint is simply *go slow*. Illustration—Take V. Hook's valve motion diagram, first page of the American Machinist of Sept. 27th. I venture the assertion that—nine out of ten familiar with some other method of diagraming valve motions failed to see or acknowledge its superiority. Also, I assert, that nine out of ten who knew nothing of the subject, and read the article straight through, were as confused and knew as little as if they had gone over the same amount of mathematical formula. And it is not V. Hook's fault either, for the method is a simple one, told in a plain, straight-forward manner. If those who do not understand it will proceed in this way, that is, take some engine they are familiar with or get the dimensions of the first slide valve engine at hand; get drawing tools, drawing board and tram or beam compass; then begin at the beginning of the 2nd paragraph of the article and do what it says in the first line before reading the second. After having done it, read the second line and do what it says, and so on to the end. Then, if possible, compare the result determined by the diagram with the facts of the case shown by the engine. If, when they have gone through in this manner and have not mastered his method, it is because they have taken a square hold with too big a subject, and it has thrown them.

The proposed new Victorian tariff fixes the duty on machinery at twenty-five per cent. *ad valorem*, and increases the ten per cent. and the fifteen per cent. duties to twenty per cent.

The iron moulders of Tuttle & Whittemore, at Union City, Conn., have struck, because the demands of the trades union that no more apprentices be employed, and that wages be increased 15 per cent., were not complied with. There are, however, enough non-union men and apprentices to carry on the works.

When some genius can invent a patent umbrella-returning attachment, that can be guaranteed to work automatically and promptly, whenever an umbrella is borrowed or stolen, then the country may indeed be congratulated. Until that day arrives, the great mass of our people will have to tie to alpaca.

"My cash discounts keep my household," was the sententious reply made by a retail merchant, when asked how his cash-buying and selling had succeeded. By this he meant that he saved enough in the discounts taken off his invoices for cash payments, to maintain his family. The experience of this storekeeper may help the weak faith of some others, if they have the pluck to do as he did. Beginning business about 1860, on a few hundred dollars, he lived and kept house on $300 per annum; sold to no one except for cash; bought nothing he could not pay the money for at the time; the result is that to-day this gentleman is well-to-do, and has an excellent trade. Another dealer in the same county, twenty years ago began a small shop with $200 worth of goods, paid for. He too, sold for cash, worked hard and lived cheap, in early years, making his purchases all the time in this city with ready money. In thirteen years that man retired worth $50,000. What these men have done can be done by the men of to-day equally well; but there may be a hard road to travel, and they must "pull off coats, and roll up shirt sleeves."—*Monetary Times.*

Columbia College Professor.—"Now I ask you, as a student of practical mining, what spade do you think the very best?"

Third year man (scornfully)—"Why, the ace, of course." (Sensation.)

The Stove moulders of Cincinnati, Louisville and St. Louis abandoned their strike and went back to work at old prices. It is uphill business for citizen stove moulders to compete with prison convicts, on the same kind of work, at 40 cents a day.

Omaha, Nebraska, is to have a new tannery to cost $25,000.

Lathe Dogs and Drivers.

BY JOSHUA ROSE, M. E.

One of the oldest forms of work drivers for lathes is shown in Fig. 1. It consists of a small chuck, screwed on the live spindle, and containing the live center and a driving arm, B, which passes through the chuck, and is set to any required distance, out by the set screw, C. The objection to this is, first, that either the live center must be very short, or the arm, B, must be very long; and, second, if the chuck wears out of true, it carries the live center also out of true; hence this class of driver is but little used, even in foot lathes.

The ordinary lathe dog is shown in Figs. 2 and 3. The hole, A, to receive the work, W, is made of the form shown, so that the work shall have contact on the sides, B and C, and not at the bottom, D. This keeps the work in a fixed position in the dog, and prevents it from rolling when the set screw is being tightened up. It should be placed as near the end of the work as convenient. The objection to this form of dog is, that it receives its driving power at E, which is at a leverage to the lathe center, and, therefore, tends to spring the work out of the straight. Thus the driving power is at E, the resistance at T, which is the turning tool, S being the cut taken by the tool. On a long, slender spindle, or in heavier work, with a deep cut, the work will spring or deflect from this pressure, which it will do the most in the middle of the length of the work, where it is the weakest.

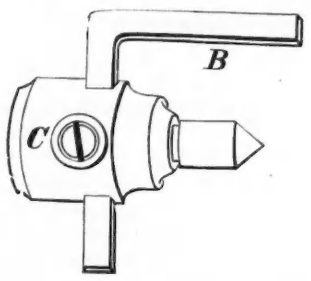
This pressure may be reduced by using a dog without the angular bend, C, driving the dog from a pin fast to the face plate, as in Fig. 4, in which S is a spindle, T the turning tool and B the dog. In this case, the power is applied to the dog immediately over the end of the work, and, therefore, at a leverage to the lathe spindle, which being, as a rule, more rigid than the work, is better able to resist the torsional strain. But there is, nevertheless, a strain, due to the pressure of the cut C, tending to spring or deflect the work in the direction of the arrow. This may be still farther obviated by driving the dog from both ends by two driving pins fast to the face plate, as in Fig. 5. The objection to this is, that only when the work is quite true will the pins, B, B, have an equal pressure—be equal on both pins. But this end may be more perfectly attained by letting the pins fit loosely in the holes or slots in the chuck, and not fastening them firmly to the chuck until a cut has been started, when the pins will adjust themselves to bear on each end of the dog, and may be screwed firmly to the plate. There is, however, no assurance that the pressure on both pins will be equal, and the device is, to that extent, imperfect.

Another method is to use a driving clamp, such as shown in Fig. 6, so that, by unscrewing one and screwing up the other of the bolts, the two arms may be brought to bear upon the pins.

In yet another system, four set screws are employed, with two arms, D, D, in Fig. 7, the set screw being so adjusted as to bring the arms against the pins in the chuck. This, however, is no better than the clamp in Fig. 6, while the screw ends are apt to damage the work, unless small pieces of copper are placed beneath them.

In the Clements' lathe driver, shown in Fig. 8, the work is held by the dog, B, and is driven by the plate, A, which is held to the lath face plate by two bolts, holding dies, *s s*, which slide in the two slots shown, so that the plate, A, is free to slide on the latter face plate. Two lugs, C, C, meet the dog and drive it from each end, the plate adjusting itself to place an equal pressure on each end of the dog. This driver is especially useful for large work, such as axle turning, or for long spindles, where the work is, from its weakness, especially liable to spring or deflect from the pressure of the cut. For flat or square work, the driver shown in Fig. 9 is employed, and, if the end of the work is at an offset from the center of the part to be turned, a piece to receive the center may be clamped in. The driver, to receive the center, wherefrom to turn the work thus, in the cut, A, is the flat end of the work, and B, a piece of metal to receive the center, C.

In a recent English invention, the dog is constructed as shown in Fig. 10. It consists of a disk arched to receive a lever, C, which is pivoted in the disk at D. A set screw provided in the disk binds one end of the lever to the work, and as the pressure to drive the work is applied at the other end of



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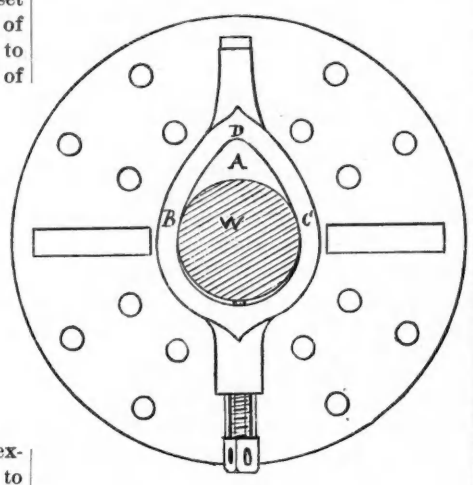
the same lever, it serves to assist (to some extent) the set screw in bending the lever to the work. The work is held between a V in the disk and one on the lever, the object being to provide a large area of contact, and thus prevent the damage to finished work which screw-ends are apt to cause.

This device does not present any special merit, since it attains no end not attained by the form of clamp shown in Fig. 8, which is much lighter and easier to handle. Furthermore, when the work is gripped by the set screws, it is an easy matter to cover it with a copper or brass ring, such as shown in Fig. 11, which may be opened or closed, within certain limits, to suit the diameter of the work being placed on the end of the work, and within the dog, to receive the pressure of the set screws.

Sometimes, as in screw cutting, the lathe requires to rotate backwards without any lost motion between the driver and the face plate, and, in this case, a face plate, such as shown in Fig. 12, is employed. It is provided with four slots, A, B, C, D, one arm having the set screw, E. The form of dog shown in Fig. 13 is, in this case, employed, the set screw, E, bending the end, D, of the dog against the opposite side of the slot.

The elevated railroads in New York have developed a new and very unpleasant variety of porcine animal. This description of beast rides in the elevated cars and spits out of the window. It doesn't require much of an aim to hit somebody on the sidewalk below.



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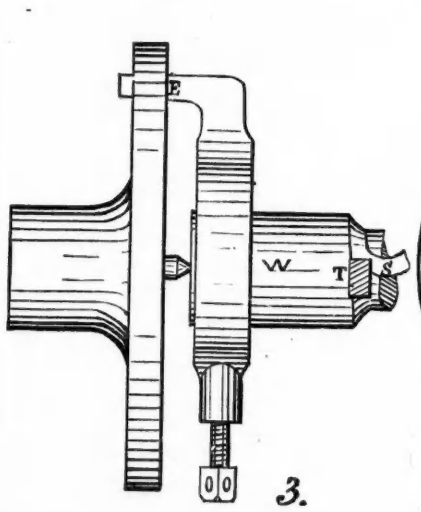
Several of our exchanges have mentioned a Union Pacific stock car, which seems to have attracted much attention in the course of its travels. As described, the car had a water-tank under it that would hold about 20 barrels of water, to which was attached a pump that was operated from the roof of the car. On the under sides of the roof were two or three leaden pipes that were little less than sieves on the lower side, and when the shipper wished to water his stock, all he had to do was to climb to the roof of the car and do a little pumping, which would give the stock in the car a complete shower-bath. The operation could be done as well while the train was moving as standing still. The car was also partitioned off in sections, preventing stock from crowding into one end of the car and piling upon each other.—*Railroad Gazette*.



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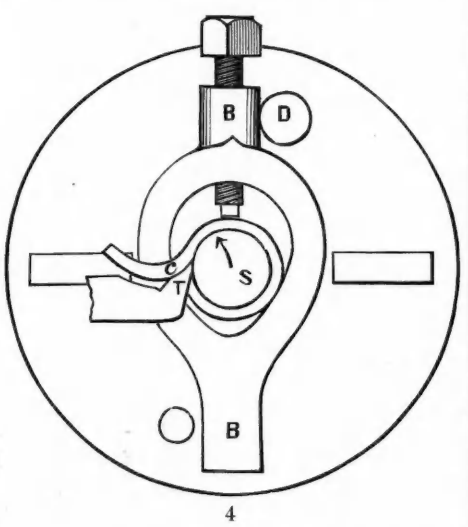

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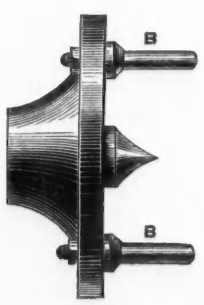

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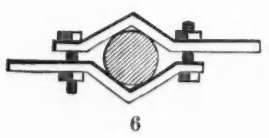
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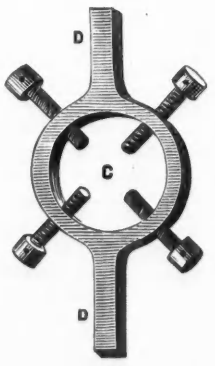

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The Clyde shipbuilders have advanced the rates for the construction of new vessels about a sovereign per ton, to meet the advance in the price of iron.

Iron mining matters are very active throughout the iron section, and the Dover (N. J.) *Era* says that five hundred additional miners are wanted to-day in Morris county.

Business has not been as brisk in the manufacturing establishments of the city for more than six years as at the present time. Many of the shops are two and three weeks behind their orders, and some of them have begun running nights.—*Worcester Spy*.

Advantages of High-Speed Engines.

BY CHARLES T. PORTER.

No. 7.

The formula which we have been considering is, in practice, subject to a modification, occasioned by the angular vibration of the connecting rod. The effect of this vibration is an increase in the velocity of the piston at the end of its stroke farthest from the crank, and a corresponding decrease at the end nearest to the crank. To get the distance actually traveled by the piston, while the crank is moving through any given angle from the line of centers, we must add to the versed sine of that angle in the former case, and subtract from it in the latter, the versed sine of the angle, which the connecting-rod forms with the same line.

Any one who can draw a circle and an angle, can verify this. To avoid any confusion, it is only necessary to bear in mind that the velocity of the crank is always taken as uniform, and so equal arcs represent equal times and different distances traveled by the piston, while the crank is traversing equal arcs, show different velocities of the piston.

These differences are greater than would generally be supposed. The speed with which the piston approaches and leaves the farther end of its stroke is 40 per cent. greater than that with which it approaches and leaves the nearer end, when the length of the connecting-rod equals 6 cranks; and this difference amounts to 50 per cent. when the connecting-rod equals 5 cranks, and to 66 per cent. when the connecting-rod equals only 4 cranks.

The accelerating force varies directly as the velocity imparted. This is obvious; for suppose that a given force imparts to a body a given velocity, then the same force, applied again, will again impart the same velocity in addition to the former; and so, in any given interval of time, the body will have attained a double velocity, having also been moved through twice the distance.

A ready way to compute the difference in the opposite initial accelerating forces, which the angular vibration of the connecting-rod thus occasions, is, to divide the mean force, found by the formula, by the length of the connecting-rod in cranks, as by 6, or 5, or 4, in the cases above mentioned, and add the quotient to the mean, for the force at the farther end of the cylinder, and subtract it from the mean for the force at the nearer end.

Now, for an illustration: Take an engine of 5 feet stroke, making 50 revolutions per minute, with a connecting-rod 15 feet, or 6 cranks, in length.

$$R^2 = 2500.$$

$$L = 2.5$$

$$(2500 \times 2.5) \times .000341 = 2.13125$$

The initial accelerating force, with a connecting-rod of infinite length, would thus be equal, on each dead center, to 2.13125 times the weight of the reciprocating parts.

With the connecting-rod supposed, it is, on the back center, equal to 2.4864 times, and, on the forward center, to 1.776 times their weight.

A simple experiment will exhibit this force, and demonstrate practically the truth of the formula.

Compute, in any engine, as above, the relation that the initial accelerating force—say on the back center—bears to the force of gravity. Then attach to the cross-head a stiff arm, that will impart the motion without vibration. Turn two pulleys, the diameters of which shall be to each other as these two forces. In the above case, one would be 2.4864 times the diameter of the other. They can be best turned out of one block of wood, as they must revolve together. Arrange them to turn freely on an arbor, and introduce a coil spring to keep the first cord tight, and overcome the friction. Connect the larger pulley, by a cord, to the end of the arm, and, by another cord, suspend a weight from the smaller pulley in such a manner that it falls while the piston is on its forward stroke. At the commencement of its fall, the weight will have allowed to it precisely the velocity that gravity would give it, but, afterwards, less, because the acceleraiton of

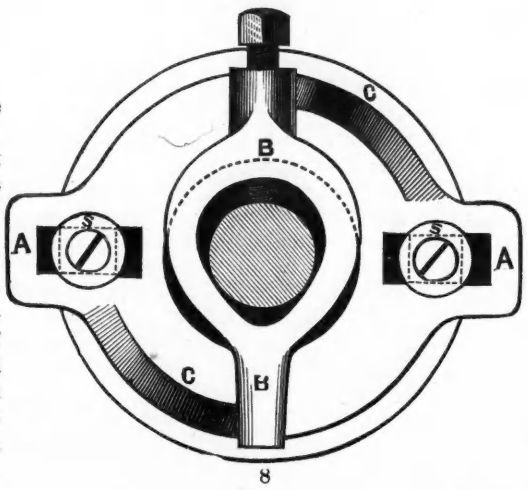
the piston is, as we have already seen, continually diminishing, while that of gravity continues the same; and so the line will be kept straight. Now reduce the diameter of the larger pulley a very little, and, at the commencement of each forward stroke, this line will be seen to be given out faster than the falling weight will take it.

Railroading Emergencies.

Editor American Machinist:

It has often appeared strange to me that locomotive firemen, and even engineers, of five or six years' experience, should be as ignorant of the functions of the machinery of the locomotive as they are, being in daily contact with it, too. It is not an unfrequent occurrence to see an engineer taking down one side of his engine, because she has slipped an eccentric, nor for him to pull her fire, because he does not know how to disconnect her; and humiliating as it must be, be towed in because his engine has broken a wrist pin.

This almost universal ignorance on the part of young engineers, must be due in a great measure to the jealousy on the part of older runners, who probably think that as they had to knock out what little they do know, it is no more than fair that the younger men should too. This close-fistedness is characteristic of all men whose stock of knowledge is limited. Even if the younger runner plucks up sufficient courage to go to the foreman and admit his want of information, it is generally given in such a patronizing manner as to knock all of the confidence the man has out of him. I knew, once on a time, a certain type of railroad foreman—an individuality, I regret to say, not infrequently met with. If a young runner, out of desperation, asks him what to do if a side rod breaks, he will tell him if a crowd of wipers are within earshot to wonder at the profundity of his learning, and the density of the young runner's ignorance in about this style, bellowing it out, "What would I do if I broke a side rod? seems as if you'd ought to know by this time; why I knew every disconnection before I'd been on the road six months; why, take down the other rod, of course, any fool would know that much; better go back to firing." If there are no wipers, the answer is "go to —— and find out." Young runner values his job more than the satisfaction of knocking him endways; foreman knows it. Having had some experience on the footboard myself, I will endeavor to enlighten any young runner to the extent of my knowledge. In case of a broken side rod, disconnect the broken rod and the opposite side rod also. This is all that is necessary. The necessity for taking down the other rod is this: if only the broken rod were removed, and the pin on that side was on either quarter, the pin on opposite side being on the center, could not start the back drivers through its side rod, in case the front wheels slipped slightly on the start. The result would be that the back wheels, not being compelled to slip with the front ones, would remain nearly stationary; the front pin would pass the center, and the back one, retaining nearly its original position, would either break or bend the side rod. If a main rod breaks, disconnect it, block the cross-head at the back end, disconnect the valve stem, tie it to the hand rail, and go ahead. Always block a piston or cross-head at the back end, as if it should get loose the front head alone will suffer, instead of the back head, which is costlier. Blocking for the cross-head is not as good as the following: Have the blacksmith make a hook out of a piece of one inch or inch and a half round iron, also a piece about 14 inches long and three inches wide by one inch thick. This piece has a hole in the middle for the end of the hook to pass through. Now when it is necessary to block a cross-head, get it to the back end of the guides as far as possible, pass the hook around the wrist of the cross-head and the other end through the straight piece, which bears against the yoke, run up a nut on the end of the hook, hard against the straight piece and the piston is secured. In case of a broken leading wrist pin, the main rod and side rod on that side, and the side rod on the other side must come down, the piston blocked and valve stem disconnected and hung up out of the way. The piston is blocked by some



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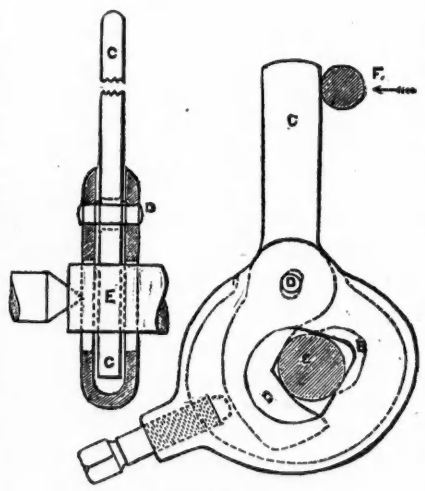
runners by allowing the front part to be open, the piston being at the back end and cocking the stuffing box gland to hold the valve in that position. This is not an advisable plan as it may hold, and a sudden jar may shift the valve, as happened once after the engine had run seventy miles, and in going off the table in the round-house, had the head punched off by the valves shifting. In case of a back or trailing wrist pin being broken, both sides must come down; if the valve stem breaks, take it down, also the main rod



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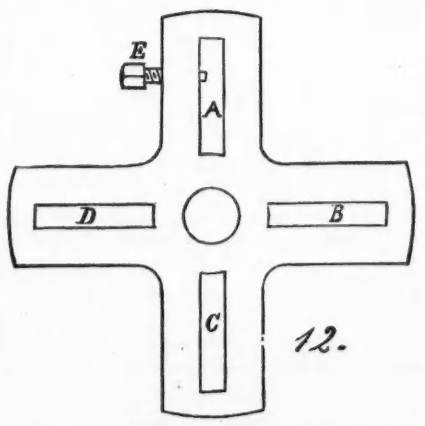
on that side, and block the piston. If the stem is broken outside of the chest let the piece remain in the stuffing box; if inside fit a small block of wood into the stuffing box, fill in a little packing and screw up the gland. If an eccentric rod breaks, take both of them down, if it is a back-up rod, and if the go-ahead rod is broken it alone may curve down with the straps, also the main rod on that side and valve stem. If the lifter or tumbling shaft arm, or saddle pin breaks, a piece of wood may be fitted in over the block for the



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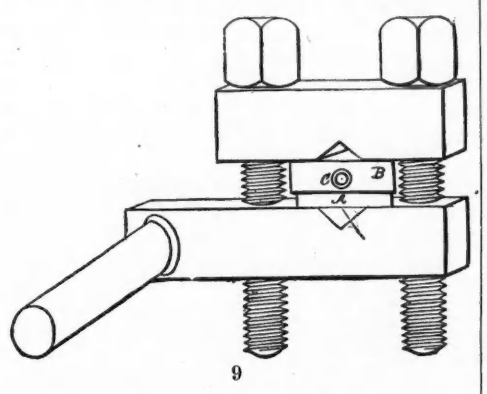
link to rest on. This piece may be long enough to raise the link to cut off about equal with the other link when raised to the point you will run her at most. The same directions hold good in case of a broken eccentric strap as for broken eccentric rods. For a slipped eccentric, which is a thing of the past nearly, owing to keys instead of set screws; assuming that it is a link engine, and the slipped eccentric is a go-ahead one, and not marked so that it can be replaced by them, put the engine on either center on that side (slipped eccentric side), pull the reverse lever in the full back-up notch; mark the valve stem flush with the gland with a knife blade; throw the lever in the forward motion notch; turn the slipped eccentric till the mark on the valve stem re-appears, notice that the eccentric is not in the same position as the



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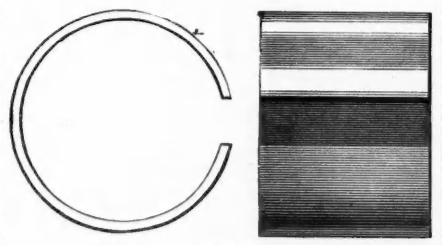
back-up one, but the full part opposite; fasten it and pull out. A broken spring hanger, requires that the spring be removed, unless an extra hanger is carried. In either caase, jack up the back end under the foot board, and either put in a new hanger, or remove the spring and slip a block under the equalizer. The engine should be run slowly. If the equalizer breaks, jack up behind, take out the springs and broken equalizer, and fit wooden pieces over the driving boxes and under the frame, to hold the engine up off of the boxes. A broken tire, if clear off, requires that the wheel center be kept from the rail, by either running the wheel up on a block of wood, or with a jack under the pin and a block of wood slipped under the oil cellar and pedestal brace; the two side rods should come down if the wheel is a back one, also if it is a forward wheel, as should the main rod on that side also. Whenever the main rod comes down, the piston must be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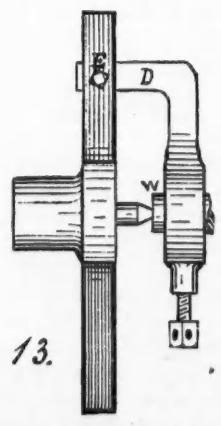
blocked and the valve stem disconnected, always. A broken front truck wheel or axle ought to put an engine *hors de combat*, but I have seen them chained up by the corner of the truck and worked in by steam, but the risk of going into the ditch is too great. Better get her on to the nearest side track and wait for her new wheels and axle. An unshipped throttle need not prevent an engine from coming in herself and bringing her train. She can be worked by the reverse lever, pulling it into the center notch to



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"shut off." It will take generally two men to handle the lever with safety. The steam pressure ought to be reduced to help matters, and no particular inconvenience will be experienced, except taking water, which is "business," and can only be accomplished with the brake set, and a man at every wheel almost, with a stick of wood to block her.

Yours, V. HOOK.

The recent session of the Roadmasters Association devoted a great deal of attention to the subject of *spring-frogs*, which would seem to imply a really reckless disregard of the season. Whether these gentlemen refer to the frogs of last spring or next spring, was not made clear in the debate: possibly to both, as the discussion was held in the fall. Now, if they will only hold an extra session, and tell us all about the fall-frog, we shall no longer have an excuse for not being happy.

At a late meeting of the Bar Iron Manufacturers' Association, in Philadelphia, the following comparison of prices was made:

	Feb., '79.	Oct., '79.	p.c.
Forge pig iron.	$13.50*a*14.50	$27.00*a*29.00	100
Soft coal at mines, ton...	55*a* 60	1.00*a* 1.25	100
Bar iron, ton..	44.80	71.68	60
Nails, keg.....	2.10	3.60	71

Many articles of heavy hardware, with pig iron for their base, show much less percentage of advance. The cost of all these articles is further enhanced by advances on labor, supplies, freights, etc., and all manufactured goods will bear still higher prices.

The question, How about "over-production" and ruin from "too much machinery"? was answered in this terse and sensible paragraph:

That is nonsense now as it always was. The increase in labor-saving machinery may cause a temporary trouble during the transition, but the outcome is beneficial. As to "over-production," all production is the creation of wealth; hence, over-production should mean too much wealth! The truth is, what we call "over-production" is but a partial suspension of consumption, owing to disturbances in general business. It rights itself by the creation of new markets, or when consumption is resumed. Since the panic of 1873 burst upon us the prostration of business has enforced idleness upon thousands, and reduced the income and consumption of all. Six years have largely increased our population, and all business has revived; hence, consumption has caught up to, and even temporarily exceeded, production. Besides, immigration is addding to our numbers, and increasing the consumption of home products, and swelling the products for export. This will be largely increased when the farmers of the old world understand that rich tillable lands can be bought in the West for a less sum per acre than they now pay annually for rent. Verily, we have a "goodly heritage."

The facts have just come out that the order for 100 iron railroad bridges for Costa Rica, which has been going the rounds of the press, is nothing more than a contract for a 340 feet span over the Barranca. It must have been Eli Perkins, or some other distinguished reporter, that first gave that item to the press.

The employees of the Reading (Pa.) Terra Cotta Works, run by E. S. Fox & Co., struck recently for an advance of wages. No notification had been given the firm by the employees of their intention to strike, they merely refusing to go to work when the whistle was blown. The men demand an increase of ten per cent. on present wages.

The trackmen on the Delaware, Lackawanna & Western Railway, also the men employed at the Stanhope, N. J., furnace, have had their wages increased 25 per cent.

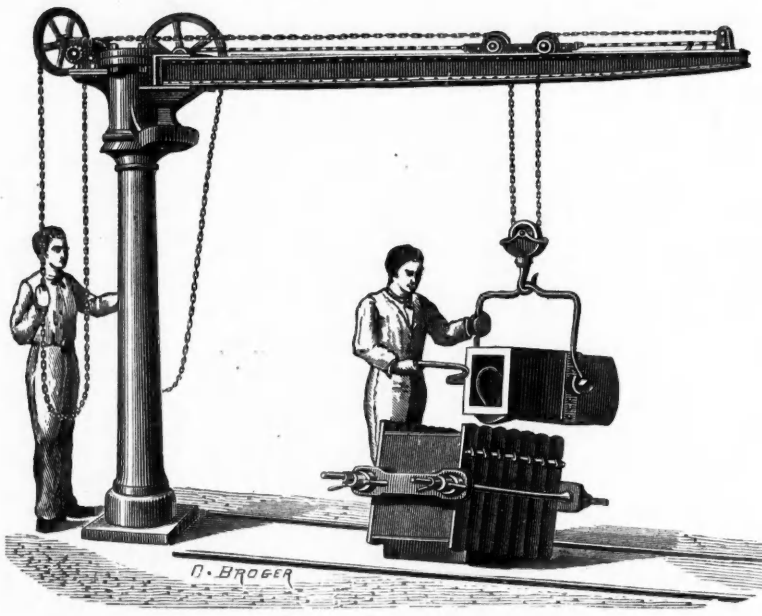
A large force of men are now engaged in putting the road bed of the Delaware River Railroad in order. This done, the company intends to buy its own rolling stock and operate its road without the use of the locomotive and cars belonging to the West Jersey Railroad.

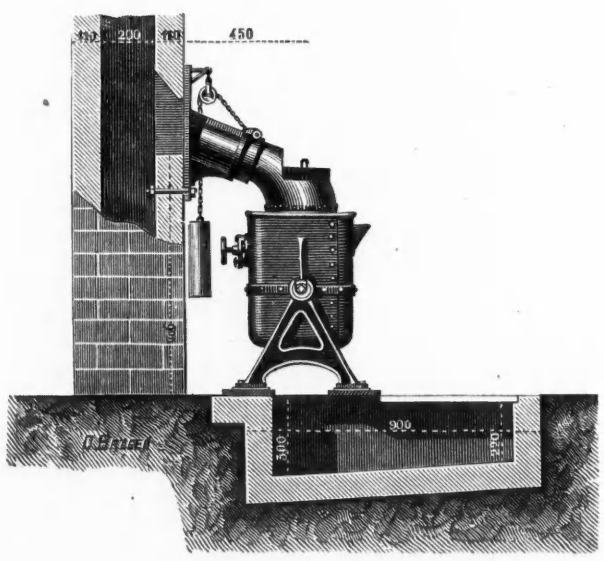
A strike has occurred among the Union moulders in William's foundry, Montreal, on account of the dismissal of the vice-president of the union for objecting to work with non-union men. The strikers' places were promptly filled by non-unionists.

The coopers at St. Louis, Mo., have started a co-operative shop, giving employment to one hundred men.

New Melting Furnace.

Steel and brass melting have been little aided, since the world began, by improved appliances. As we now melt in plumbago, or clay pots, the crucible must be well centered, carefully held lest it tip, and the grate kept sliced clean, while melting. For pouring, the pot is lifted out by tongs, thus destroying the good fire. The air and the tongs chill the pot, and the last casting, if there be many, is run cold. A pot broken while carrying is wasteful of metal and not pleasant for the men. Graphite pots are especially brittle and liable to crush by the tongs. For the next melting the fire is to be remade, involving a waste of time and fuel. We say, 50 lbs. coke for 100 lbs. of brass, and sometimes it runs weight for weight. For steel, 2½ to 4 lbs. of coke to one of metal—and the heats far apart—3 or 4 per day, the quantity of metal lessening each time as the pot gets shorter and weaker.





A No. 50 graphite pot makes 3 heats in 13 hours, and stands 6 heats, having made 425 lbs. of steel. A clay pot lasts only 3 heats and melts but 120 lbs. of steel. Clay pots last a day, or 10 to 21 runs for brass; plumbago giving 30 to 40 heats.

A novel arrangement, shown in the annexed cuts, keeps the pot always in the furnace, and slings the latter on a crane, so that the whole can be carried anywhere and tipped in any direction. This saves coal, pots, burns, and cold runs. There is a small size with trunnions, that two men can pick up; a larger to be slung to a crane; another style with a chariot having lateral and lengthwise traverse, and special pouring trunnions to keep the stream steady; and in case of the larger sizes for steel melting, the whole is kept, while not pouring, attached to a recuperator or regenerator (shown in section). The inventor is Mr. A. Piat, a founder and machinist, 85 Rue St. Maur, Paris, France, and the device which will be made in this country by R. Grimshaw, of Philadelphia, was shown at the Paris Exposition last year.

We have secured the cuts and append them hereto for the information of our readers.

The Impending Crisis.

Editor American Machinist:

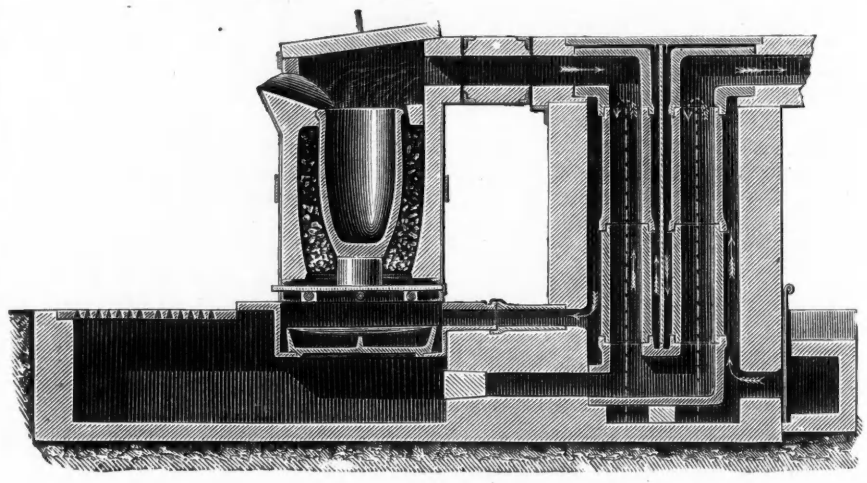
Unless present indications are very deceptive, the pages of the AMERICAN MACHINIST are destined to be the field of conflict, with "compression" for the issue.

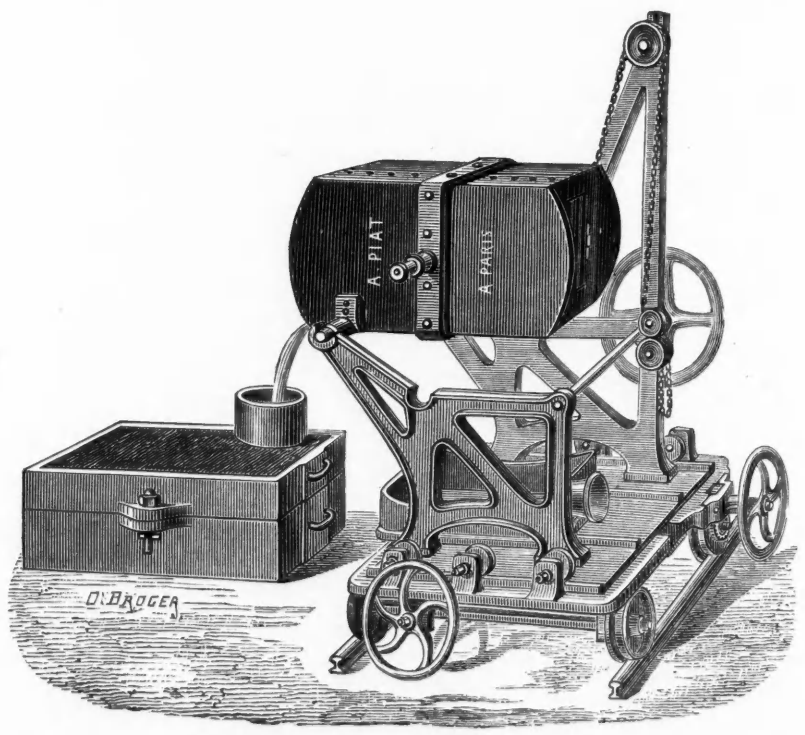
Lately there has been considerable skirmishing on both sides of the question, all along the line, and in No. 21 I noticed that our friend Roper sends out a few feelers, and in a manner characteristic of his practical style, calls for a few "stubborn facts;" and also states that theoretically there is no economy in compression. Now, I propose to make some reasonable theoretical statements, and perhaps cite one or two "facts" bearing on the subject. Many of your correspondents hover about the margin of the subject, and do not seem to deliver their fire with precision. Mr. Roper truly remarks, that "bold assertions and blank denials" go for nothing, and therefore I shall endeavor to exhibit something, which, if it cannot be called "fact," will at least prove tolerably "stubborn" when an effort is made to overthrow it.

The first steps, evidently are, to determine what we are aiming to do, and how we are going to do it, in view of which it will be well to remark, that the object aimed at by compressionists is "economy;" and its effects in this direction are twofold: first, providing a "cushion" for the absorption of the momentum of the reciprocating parts, and for "taking up" lost motion, at the completion of the piston's strokes, and thus prevent shock and wear; second, filling the waste space at cylinder ends with steam, and so reduce the amount to be drawn from the boiler at each stroke.

There are probably few engines built in which sufficient compression can not be obtained for taking up lost motion, when the crank is passing its centers; but there are *very few* engines built in which compression can be carried to any thing like 60 to 70 pounds per inch above the atmosphere—with economy. The conditions necessary for best results in compression are: 1st, least possible clearance or waste room at the cylinder ends; 2d, *high piston speed*; 3d, dry steam.

It is, I believe, very generally conceded, that compression, as a means of cushioning the piston, is conductive to economy, and indeed is advocated by some as a positive necessity in operating a "high speed" engine. Very little will be said, then, for the present, in that direction, therefore we will consider the claims of compression, as an economical process, by means of which steam or heat is to be saved; and for an example I will suppose a cylinder with an effective area of 660 square inches; stroke of piston, 5 feet; revolutions of shaft per minute, 50. It will be observed that each pound of effective pressure develops 10 H. P., and further, we will assume that the reciprocating parts of the engine are without weight, then, all compression and resulting friction will be produced directly from the power stored up in the balance wheel. The waste room at cylinder ends is three per cent. of the volume of piston displacement; this will amount to $\frac{687}{1000}$ of a cubic foot. Now, at each stroke of the piston, the waste room at the corresponding end of the cylinder must be filled with steam, up to initial pressure, before the piston starts on its stroke; for if the piston moves, say 3 inches, before initial pressure is reached, we are filling part of the volume of displacement *after the piston has passed through it*, and thus lose a portion of the effective pressure, even though we are obliged to go to the expense of filling the space with steam: the loss, to be sure, is small, but it must be borne in mind that the nearer perfection we get, the closer must be watched these small gains and losses. In a non-condensing engine, providing there was no counter-pressure or compression, there would be in the waste room, when the piston had finished its stroke, just one atmosphere of pressure, or, say 15 pounds per inch above perfect vacuum—supposing the initial pressure to be 60 pounds above atmosphere, or 75 pounds absolute pressure. A plain statement of the case, then, would be as follows: Required, $\frac{687}{1000}$ cubic foot of steam at 75 pounds pressure, weighing $\frac{123}{1000}$ of a pound and containing 144 $\frac{73}{100}$ units of heat, to fill waste room. We have on hand $\frac{687}{1000}$ cubic foot of steam at 15 pounds pressure, weighing $\frac{26}{1000}$ of a pound and containing 30 $\frac{55}{100}$ units of heat; the difference between these two sets of quantities is, of course, the amount that *must* be furnished from somewhere to fill the waste-room; and now we arrive at the pivotal point of this whole business. We have considered the first part of the proposition, viz.: What are we aiming to do? And now comes the second part, and a determination must be reached as to how the thing is to be accomplished. The question arises, which is the cheapest—to call on our reservoir of work, the boiler, or on our other reservoir of work, the balance wheel? The correct answer to this question will settle the case for or against initial compression. Let us investigate. If the boiler is drawn on for the necessary supply, the exhaust valve is held open until the piston has finished its stroke, then closed, and the induction valve opened. If, on the contrary, it is decided to obtain the desired result by compression, the exhaust valve is closed before the piston has finished its stroke, at a point that will imprison within the cylinder, a volume of steam at the pressure of atmosphere, equal in weight and in units of heat, to a volume of steam that will just fill the waste-room at a pressure of 75 pounds per inch above vacuum; and a certain portion of the dynamic energy stored in the balance wheel, is expended in the work of forcibly reducing the volume of steam contained in the cylinder—the volume decreasing and the pressure increasing, until piston has finished its stroke and waste room is filled with steam at initial pressure.





Now, some authorities assert that the com-

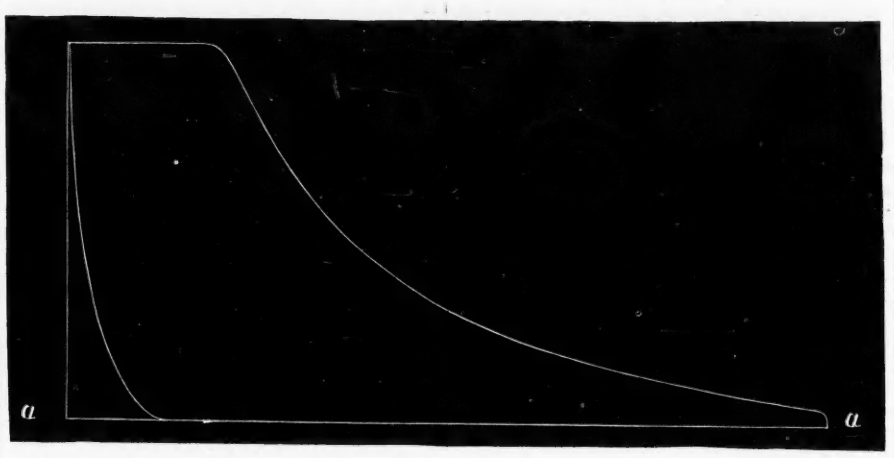
pression curve rises more rapidly than would be indicated by the proportion of volumes, and the position seems to be well taken. To illustrate; in the case at hand we wish to compress from 15 to 75 pounds per inch, ratio of pressure is 5; by Marriotte's law this would demand a ratio of volumes of 5, that is, when exhaust valve closes, there would be a volume of space in front of piston (including the waste room) of five times the waste room, and when the crank reached the center, the piston would have reduced the volume so that nothing would remain but the waste room, thus reducing the volume to one-fifth and (Marriotte's law) increasing the pressure five-fold; but when we compare the units of heat and density of the steam at 15 and 75 pounds per inch, we find that the ratio existing between these two pressures is only about $4\frac{7}{10}$, and the reason is that there is sufficient material (heat and water) in $4\frac{7}{10}$ volumes of steam at one atmosphere pressure to make one volume at five atmospheres' pressure; and right here another element forces itself into notice, viz.: the heat into which the dynamic energy is converted when it (dynamic energy) is taken from balance wheel and expended in compression, it being remembered that steam in expanding converts heat into dynamic energy, and that dynamic energy in compressing a gas, is converted into heat. A familiar instance of this last phenomenon is the latent and sensible heat developed during compression of air; and right here is a good place to "let off" a "stubborn fact," and that is, compression curves can be, and are, formed that run far higher than can be accounted for by ratio of volumes, and are owing, no doubt, to the fact that there is added to the compression of imprisoned steam the evaporation of excess of moisture in exhaust steam by the *heat equivalent* of the power expended during compression; this would, of course, produce a certain amount of "compression," *with a later closure of exhaust valve*, than could be expected from relative volumes.

A practical method of comparing both sides of the question is, to estimate the number of foot pounds of work developed, during the consumption of 100 pounds weight of steam, both with and without compression. In the diagram herewith presented, the expansion and compression lines are Marriotte curves, for the reason that, for expansion, this curve is as good as need be expected; while, for compression, it reduces the area of diagram to a greater extent than should be realized in good practice, and, therefore, I claim, that if economy can be exhibited where such a curve is produced, the chances are that we shall have something to spare, with a proper proportioned engine and dry steam—probably enough to cover friction.

To return to the diagram. The engine indicates 270 H. P., without compression, and 255 H. P., with initial compression, the absorption of power to compress being 15 H. P. But when the weight of steam consumed is considered, in each case, the exhibit is as follows: Duty, without compression, 9008010 foot pounds, with 100 pounds' weight of steam used; duty, with initial compression, 9508950 foot pounds, with 100 pounds' weight of steam used; *showing a balance in favor of compression* of 500940 foot pounds.

The friction of the engine due to compression is, of course, to be deducted from above gain, but, let me ask, How much friction would 15 H. P. create in an engine of the given dimensions?

Now, remember, that, in the foregoing speculation, reciprocating parts are considered without weight. We have drawn on the energy of balance wheel to effect compression, but if the "momentum" of those parts at end of the stroke should happen to equal the initial pressure (gross), initial compression would be produced without the balance wheel knowing anything about it. A comprehension of this effect may be realized by refering to Mr. Porter's treatment of acceleration and retardation of reciprocating parts. At the middle of stroke, when those parts are flying along at a speed equal to that of the crank-pin, if an ordinate could be drawn through the pin and perpendicular to engine center line, it (ordinate) would be observed to slacken its speed and, finally, completely stop when the crank reached the center; but the moving parts have been accelerated to a high speed during first half of stroke, and now, as the crank-pin motion (in a line parallel with engine center line) begins to slacken, the reciprocating parts, having received no notice of the fact, begin to exert their "inertia of motion" directly against the pin. The more the pin tries to slow, as the curve of its circle approaches the perpendicular, the harder the "movables" push against it, until, as the engine nears its center, and the "retardation" of the moving masses is rapidly nearing its most desperate point, and also reaching a point where the inertia is producing but little "driving effect" on the crank, the exhaust valve closes, compression begins, and the attention of inertia is diverted from the crank-pin, and expends its entire energy in reducing the volume of imprisoned steam; so that, when the center is reached, all lost motion is taken up, or reversed, and the piston and connections have, already, before induction valve opens, a force *behind* them sufficient to start them on their "accelerating" journey at the next stroke.



The moving parts are, probably, never heavy enough to balance, by their inertia, the initial steam, and so, whatever they are short of "motive," must be taken from the balance wheel.

So much for "stubborn" theory. Now, for another "fact." I have had occasion to observe very closely the operation of engines with different degrees of compression, and, contrary to predictions of some of your correspondents, the steam pressure could be reduced quite as low with, as without, compression, giving one the impression that, with a *properly proportioned cylinder and ports*, the percentage of load added by the operation has, practically, no necessary bearing on the question of initial pressure.

I have a birthright privilege of answering a question by asking another, and, therefore, I answer friend Roper's "brickbat" proposition by asking him, What is the difference between adding a load by compression and throwing into gear, say a large punching machine, that will require about the same power? The demands made by such a machine, you know, are intermittent, and *may possibly* come just when the engine is passing its centers.

Mr. R. must not forget that, even if his horse should be forced to pull all four wheels on top of brickbats, the power would be returned when the wheels rolled off the other edge of the bats.

CHAS. A. HAGUE.

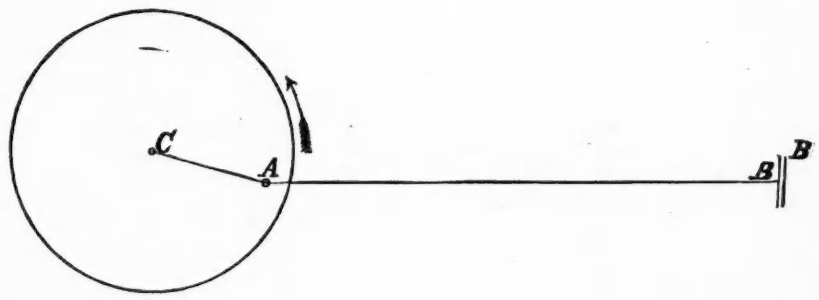
Oct. 20th, 1879.

Letters from Practical Men.

Editor American Machinist:

In a recent number of the AMERICAN MACHINIST, I notice a description and illustration of a device for *grinding* a true sphere or ball. So little is said about *turning* a sphere that I contribute my experience, or rather knowledge, of the tools used when I was an apprentice more than twenty years since. At that time many balls of composition, about 2½ inches diameter, were used for valves for force pumps, and at one time it was considered a *good day's work* to turn *one* true enough for that purpose. They were cast with a projection about ¼ diameter and the same length, on which a lathe dog could be fastened to turn them by, and were centered and roughed out in a lathe with a fixed tool, and finished with a hand tool. A man was hired who was accustomed to finish composition, and he, not knowing what a day's work was, or had been, turned *two dozen in one day*. He roughed them out the same way and then cut off the neck by which they were dogged, and the center opposite, and provided a cup of hard wood, of suitable size, for the live center of the lathe, say one-third of the diameter of the ball, and a small flat surface of hard wood for the dead center. The friction of the cup being greater than that of the small flat surface, the ball would revolve with the lathe. His finishing tool was a ring of cast steel, about 1¾ inches diameter and the same length, bored perfectly true, and squared at one end and hardened. This perfect circle, applied to the ball, would touch only on the high points, and the position of the ball being frequently changed, it was soon reduced to a perfect sphere, or, at least, so nearly perfect as to answer the purpose of a valve for a pump. Grinding, as described in a former number, would, of course, improve them.

E. S. CHAPELL, *Boston, Mass.*



OFFICE OF FIRE DEPARTMENT,
LAPEER, MICH. *October* 23, 1879.

Editor American Machinist:

The term lead is applied to an alteration made in the plan of the valve motion, for the purpose of concealing and neutralizing an effect due to imperfect workmanship, as well as continual wear in the boxes of the crank and crosshead pins. The difficulty may best be explained with the assistance of diagram.

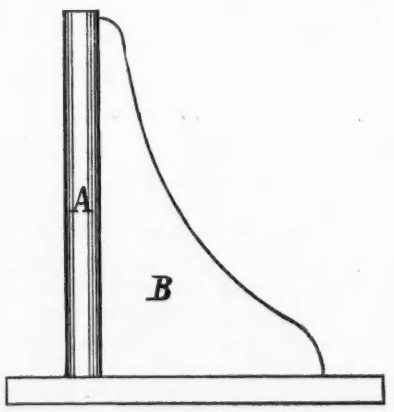


Fig 1.

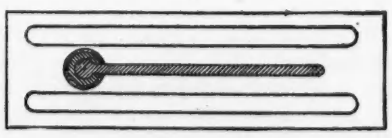


Fig 2.

Suppose, for instance, both boxes of the connecting rod *A*, *B*, fit loosely upon the crank and cross head pins, that the crank, moving in the direction indicated by the arrow, has reached a location *C*, *A*, that the piston, on account of the lost motion in the boxes, falls short of its true position *B*, a distance *B*, *B*: If now the momentum of the engine carries the crank pin past its center the piston which, at the moment of passage is no longer urged or restrained by the connecting rod, will by virtue of its own momentum continue moving in the direction of *B*, until all the lost motion being expended, its progress is suddenly chicked and it is itself again brought under the control of the connecting rod, which then draws it forward upon the return stroke. These concussions are reproduced at the end of each stroke, with a degree of force and sound directly dependent on the extent of the lost motion, and the momentum of the piston with its connecting rod, and the engine is said to pound, lead is given to the valve to to counteract this effect by introducing a resistance to the momentum of the piston, capable of overcoming it before the end of the stroke. The width of port, opening given by the valve at the moment its crank passes either center is called the lead. Since sound, the effect of lost motion, depends upon the weight and velocity of the reciprocating parts, the leap requisite must vary for different engines and also for the same engines at different velocities. The exact amount can not be predicated in any particular case, but after the engine has been run it may be experimentally determined by gradually increasing the angular advance of the eccentric until some position is found which results in a smooth and noiseless movement.

E. R. CHASE,
Secretary.

ROCHESTER IRON WORKS.—F. D. LIVERMORE,
IRON FOUNDER AND MACHINIST,
ROCHESTER, MINN. *October* 22*d*, 1879.

Editor American Machinist:

I send you herewith, a sketch of a driver, which seems especially desirable for driving pulleys. It was devised by Mr. C. W. Streetes in my employ, and has answered the purpose admirably. It prevents the chattering—so annoying, and by the use of two of them, makes as near an equal drive as possible.

Figure 1 is a cast iron driver with an upright, *A*, and flange *B*. The upright is round, and on this is slipped a piece of rubber tubing, split lengthwise (in this case, it was an old rubber wringer roll) and outside of that, to protect the rubber from chafing, was a piece of two inch iron pipe, out of which a piece had been planed to permit it slipping past the flange. The pipe was wired on by a couple of holes through pipe and flange to prevent it slipping off, though that may not be necessary. The base is slotted on both sides of upright and flange for convenience in bolting to face plate. It answers the purpose admirably.

Yours truly, F. D. LIVERMORE.

Another notable business improvement at Holyoke, Mass., is the extension of the Springfield Blanket Company's works, which will make them the largest establishment of the kind in the country. One building will be 274x45 feet, and another 65x45 feet. Ten sets of woolen machinery will be put in.

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☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, NOVEMBER 15, 1879.

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Improved Aspects of the Machinery Trade.

Careful and extended inquiries in machine shops, both East and West, give us conclusive evidence that the business "boom" has not only made itself felt, in a most gratifying manner, in the various branches of this trade, but that it is not likely to waste its energy within a few months.

The most prominent feature is a large increase of orders, in many cases giving employment to the full capacity of the shop for two to eight months ahead.

Shops that have been idle, or nearly so, for years have taken a fresh start and present scenes of activity and prosperity. There are, however, a class of shops that seem to lose rather than gain by the general business prosperity. During the times of depression these establishments turned out the most trashy and deceptive kind of machinery, which found considerable sale because it was low-priced. Declining prices and a distrust of the future impelled many parties to purchase a grade of machinery that would have possessed no attraction for them had the business outlook been more propitious. The manufacturers of poor machinery, therefore, have no reason to feel gratified over the recuperation of business enterprise. Having lost their reputation for good, reliable work, they must struggle along at a decided disadvantage. Ill-constructed tools have had thorough trial during the last six years, and have opened the way for the disposal of accurate, substantial and trustworthy pieces of mechanism, for which a healthy and increasing demand now exists.

The price of machinery has advanced very slowly, hardly keeping along with the advance in iron and labor. It is better for the trade that it is so, for the prospect of higher prices, in the near future, has a good effect upon sales.

Mechanical inventions of high merit, which have, from three to six years lain idle, are now being brought to light, and arrangements are taking definite shape for manufacturing them and placing them in use. The improved aspect of the trade is calculated to stimulate needed inventions, and to advance the standards of excellence in every branch of the machinery business.

Skillful and studious machinists, moulders, pattern makers, draughtsmen, and other artisans, are commanding higher wages than for years before, and find it comparatively easy to obtain positions that rarely offered the chance one year ago. The advancing wages of expert mechanics will tend to promote efforts towards improvement, resulting in the higher skill and greater success of thousands of artisans, who, heretofore, have felt small encouragement to qualify themselves for superior workmen.

When we consider that every branch of productive industry that contributes to the welfare and gratification of mankind is, in a great degree, dependent upon machinery for its successful prosecution, the brightening aspect of the machinery business should cause a feeling of rejoicing in the minds of all classes and conditions of people throughout this country.

Advancing Wages an Important E - ment of Prosperity.

In reckoning up the causes of our present prosperity, too little account is made of the very numerous and extended advances in wages of all kinds, that have been made during the last few months. When we consider the vast number of persons employed in many single industries in this country, we can begin to estimate the huge dimensions of the sum that even ten per cent. advance upon their yearly wages will amount to. If we consider further, that nine dollars out of every ten thus gained, will, in one way or another, be used to purchase an improved article of such necessaries as clothing, food, house rent, baby carriages, etc., thus providing employment at improved wages for other thousands of workers, the size of the wages-spending boom cannot easily be overstated.

As a rule, the money which is spent by the rich affords employment to comparatively few persons. Such luxuries as wines, fine cigars, theatre tickets, pictures, yachts, fast horses, fancy turn-outs, fall bonnets and bets on the fall elections, or the last walking match, give pleasure to few, and as a rule benefit few, while the wages-spender usually confines his purchases more closely to the necessaries that are produced in large quantities, and consequently give employment to many.

Those employers of labor, therefore, who take the strictly selfish view of the wages question, do so in direct disregard of their own true interests. It is safe to say, that, if great employers, such as Vanderbilt or Scott in railway circles, instead of trying to screw their thousands of employees down to the lowest starvation notch (as is notoriously the case among their track laborers), had, even in the dark days of the past two years, voluntarily raised all wages under their control to a figure above the prices that other roads were paying for like service, and by extensively advertising the fact, had forced other railroads and other employers in all lines of business to do the same, they might almost have laid the foundation of good times, such as we are now enjoying. Earning more money, and helping thousands of their fellows to earn more--these thousands would have spent more, giving thus an impetus to almost every branch of trade or commerce, and the railway magnates would have had their reward in improved business.

The true policy for nations, firms and individuals is the whole-souled policy that devises liberal things, and compels everybody else to follow suit. Utter selfishness is short-sightedness always. Those employers who strive with all their force against the necessity, now daily becoming more apparent, of paying increased wages to those employed by them, forget that, in so doing, they are laying sticks and stones in the path of their own progress and business prosperity.

Those alarmists, who fear that increased wages in this country will involve prices of our finished products so high as to defeat their sale abroad by substituting foreign-made goods, should bear in mind, that, with the first shred of opportunity, workmen abroad, who are now suffering the pangs of little to eat and less to wear, will begin to demand and receive advanced wages as the business of their employers revives. And thus it will be shown that liberal pay here, while it gives our American workmen an increased share in the enjoyments of life, must inevitably react upon their foreign brethren in the way of increased pay growing out of improved business.

Hints to Beginners in the Machinery Trade.

We are constrained, after long observation, to offer a few words of advice to those just starting in the machinery or machinists' supply trade. The first move should be to secure a warehouse, store, depot, hall or whatever it may be called, of such dimensions and surroundings as to give an imposing appearance. The next step is to get in "a large and valuable stock." This does not necessarily require a large capital, though it is essential to get the public to think that it does. Having once established a reputation for possessing large means, it is easy to get credit or to obtain supplies on consignment, making returns when the goods are sold. This may be a little difficult at first, but by getting out and spreading an imposing circular many small manufacturers in the rural districts may be attracted and brought to terms. If shelf goods are to constitute the stock or part of it, a large array of empty boxes or drawers carefully labeled "pipe taps," "reamers," "wrenches," "drill chucks," etc., will give callers some idea of the extent of the business carried on. If a customer comes for any of those articles named on the empty boxes, he must be informed that the particular tools desired were just sold out—"last one gone to-day," and that the manufacturers are so busy that "they don't keep up to our orders." Of course the customer can be supplied on short notice, and must be informed that a fresh stock is hourly expected. The store (or emporium) must wear the aspect of a lively business. It is well to have a few boxes packing with goods for shipment, and several others standing by filled (bricks will do) and nailed up. The packing need not proceed very briskly except when prospective customers are in. A good pile of (supposed) unanswered letters and telegrams should lie upon the desk in the office, and the proprietor should impress callers with the idea that he is straining every nerve to catch up with his correspondence. The machinery upon the floor should be moved about frequently on skids, so as to let observers see that business is being done.

A still more persuasive plan is to load up a few machines upon trucks (showing the name and business of the establishment in large letters), drive through the principal streets and finally return with the load.

A prominent safe manufacturer in this city carried out this plan very successfully in the earlier days of that business.

In bringing out a new tool or machine always be "several weeks behind orders." Don't neglect to impress this upon every inquirer about the new machine. It won't do to let the public get an impression that the article is slow of sale.

Again, be sure to convince inquirers that the remarkable demand for the machine will certainly lead to an early advance in price. We reserve further advice for future application.

Our Third Year.

This issue begins our third year of publication. As it has always been one of our fundamental principles to promise little and perform enough to merit extended appreciation, we shall not make any unusual offers at this time. The thirty-eight numbers of the AMERICAN MACHINIST that have thus far been issued, constitute the most convincing prospectus for the coming year that we can lay before our readers. It is with no small pride that we point to the achievement in two years of building up a wide-awake, independent and original mechanical journal to the high position occupied to-day by the AMERICAN MACHINIST, attracting as it has, to its columns, the choice utterances of the most widely recognized leaders of practical mechanical literature. Our progress has been decidedly gratifying, and we have not found it necessary or desirable to offer any chromos, shot guns, spy glasses, or white metal and brass watches as premiums to secure subscribers; nor have we felt the urgency for devoting any space whatever in these columns to special solicitations for subscriptions. A large and increasing patronage has been our uninterrupted experience, both as a monthly and (since last June) as a weekly; and the warmly encouraging letters we are daily receiving from all parts of the country, give full assurance that those who have favored us with their patronage, are not disappointed. No occasion has yet arisen for us to issue a "special edition" larger than our current circulation to attract advertisers.

In this connection, before dismissing the subject of our own progress, we cannot refrain from quoting the following pointed expression by Mr. Whitelaw Reid, in his address before the Ohio Editorial Association last Summer:

"Don't surrender to the vulgar folly that you must make advertisers believe that you have an incredible circulation, or even that you have the largest circulation. The value of a circulation is often comparative, anyway; one paper with a list of but 10,000 may be worth as much as another which prints 100,000. The public is finding out the humbug about big circulations, and *sooner or later it goes where it gets its money's worth.*"

There is one department of the AMERICAN MACHINIST which has developed itself, as it were, spontaneously. We refer to "Letters from Practical Men." This feature of the paper, which promises to be a particularly valuable one, has been thrust upon us without incubation or special plans of any one. It arises from the desire of a large portion of our

readers to exchange their practical knowledge through the columns of the journal devoted to diffusing original mechanical methods and suggestions. We earnestly request that each one of our readers, while profiting by the well-earned experience of others, will send something for this department which is likely to prove new and instructive to the greater number of intelligent machinists, founders, pattern makers, engineers, or other artisans, sharing in the various shop manipulations.

Machine Shop Wages.

Wm. B. Bement & Son, Industrial Works (machinist's tools), Philadelphia, pay machinists from $2.00 to $2.20 a day; blacksmiths, $2.25; helpers, $1.20; foundrymen, $2.00 to $2.50; pattern makers, $2.00 to $2.20.

McCurdy & Warden (boiler works), 277 West street, New York, pay boiler makers $2.25 to $2.65 a day, average, $2.40; machinists, $2.25 to $3.50, average, $2.50; helpers, $1.50; blacksmiths, $2.75 to $3.00; helpers, $1.70.

Gustavus Pierrez (boiler works), 357 West street, New York, pays boiler makers $2.00 to $2.75, average, $2.40; machinists, $2.25 to $2.75; blacksmiths, $2.25 to $3.00; helpers, $1.75 to $2.00, average, $1.85.

James Tubbs (machine shop), Cohoes, N. Y., pays machinists an average of $2.00 a day.

The Cohoes Iron Foundry and Machine Company employ 35 hands. They pay machinists $1.87 to $2.00 a day; moulders about $2.50, blacksmiths, $2.25.

Muldoon & Killerlane, Red Fort Iron Works (machinery and boilers), 240 West street, New York, pay machinists $2.50 a day; helpers, from $1.50 upwards; boiler makers, $2.00 to $2.25; blacksmiths, $2.75 to $3 00.

The Fishkill Landing Machine Company (engines, boilers and machinery), Fishkill-on-Hudson, N. Y., employ 40 men. They pay machinists from $1.50 to $2.25; helpers, $1 00 to $1.25.

As an intellectual diet, beans ought to take a high rank. The scientific theory is that they abound in phosphorus which is needed to supply the wear and tear of the brain. The popularity of this article of diet in Boston may go far to explain the advanced intellectuality of that city. In a late political campaign, one of the parties gave bean dinners to the crowds that came to listen to their speakers. A Philadelphia man, with nothing better to do, has investigated the bean (probably after swallowing a few quarts of bean soup) and has laboriously figured it that the first year's yield of a single bean is 1,515, and that, planting those beans, the second year's yield would be 2,295,225. The third year's planting would result in a grand total of 5,268,058,800,625 beans. And after arriving at this conclusion the statistician is arguing whether a pound of beans contains 1,921, as some one else has stated.

As Seen Through Other Spectacles.

(*From the Philadelphia North American.*)

The AMERICAN MACHINIST, one of the handsomest special weeklies that we know of, comes to us full of valuable information. Its contents include contributions by well-known practical scientists and writers on mechanical subjects, such as Prof. R. H. Thurston, John J. Grant, M.E., L.F. Lyne, M.E., and William Lee Church, C. E. It is a publication which every manufacturer, engineer, machinist and inventor should keep on his desk. The issue of November 1 contains a useful article on adjusting shafting, and another on safe-breaking, besides vigorous and sensible editorials on prison labor and mechanical education.

(*From the Chicago Daily News.*)

The AMERICAN MACHINIST (New York) is, so to speak, an educational weekly in mechanics, and occupies a field which it has made peculiarly its own, by adapting itself to the wants of skilled workers in iron. In its last issue are articles of value, with illustrations on engines, boilers, and improved illuminating apparatus. Among its contributors are some of the best machinists in the country. The value of such a paper is in its intelligent and practical treatment of matters in mechanics.

(*From the Cincinnati Daily Star.*)

The AMERICAN MACHINIST, published in New York, is a journal for machinists, engineers, founders, pattern makers, inventors, etc., and is the best journal of the kind circulating in the West. American Machinist Publishing Company, New York.

(*From the Boston Commercial Bulletin.*)

The AMERICAN MACHINIST is full of select articles on every subject pertaining to its peculiar field, by writers of eminent renown in their specialties. Among the interesting articles now appearing are "Advantages of High-Speed Engines," by Chas. T. Porter, "Bits of Experience," by Prof. John E. Sweet, "Mechanical Manipulation," by Joshua Rose, M. E., and bright articles on every day events which occur in machine shops.

Business Specials.

Forty cents a line for each insertion under this head.

Brown & Sharpe M'f'g Co., Providence, R. I., keep in stock at reduced prices Patent Cutters for the teeth of gears which can be sharpened by grinding without changing their form. All wheels of same pitch cut with them will run together correctly. Send for new catalogue.

The Huntoon Steam Governor Co., of Lawrence, Mass., warrant a direct saving in steam of from 10 to 20 per cent. over any other Governor known; while for quick and accurate regulation, great durability and lasting economy in use, they guarantee results never before attained by any other. See advertisement.

Tool Chests with best tools, scroll saws, wood and designs. Amateurs' and Machinists' Tools. Send for Catalogue. Tallman & McFadden, Philadelphia.

FOR SALE.—Two patent centering and squaring attachments for lathes; center and square up at one operation. Made by R. E. State & Co. Entirely new; price, $20 each. Lock Box 291, Springfield, Ohio.

AYER & SON'S MANUAL contains more information of value to advertisers than any other publication. Sent postpaid on receipt of 25 cents. Address, N. W. Ayer & Son, Advertising Agents, Times Building, Philadelphia.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) W. A. B., Hampton, N. H., writes: I am a machinist; served an apprenticeship of three years; have been out of my time something like three months; am not as good a workman as I wish to be, therefore I have been trying to think of some way by which I can make a first-class workman. The plan I thought of was this: that I would go to some first-class shop and offer myself, regardless of pay, for a year or two, provided that they would give me a good chance to learn. I have thought of going to a shop where they build lathes, planers, etc. Which do you think would be the better—one of this kind, or one where they build engines? Will you be so kind as to mention some of the best shops that you know of where they do such work? Please tell me what you think of my plan, and what you would do if you were in my place? *A.*—We recommend that you read "Self Confidence in Mechanics," in our issue of August 2d, 1879, also, "Decline of Skill in Machinists," in our issue of July 5th, 1879. You should have given your age, but we will judge you to be from twenty-one to twenty-three. In which case we will say that you have made an important discovery, viz.: that you know very little, which is a wonderful admission for a young man, and a good indication that you are on the right track. As you advance in life you will be more surprised at the little that you do know, for the most learned men are generally the most modest and unassuming. Having been through the process of working ourselves up, we can sympathize with you, and would advise you, as a first step towards the establishment of a reputation, to first find out what branch of the machine business you are best adapted to, and then bring all your energies to bear in that direction to advance yourself. After you have decided the branch which you intend to follow, ascertain where the best shops engaged in the manufacture of that particular branch of machinery are located, which you can easily do, and then use all the influence that you can command to obtain employment in that locality. You should then connect yourself with good society. It is a good plan to associate yourself with some church, and use your best endeavors to cultivate the acquaintance of influential men, and thus establish for yourself a reputation which will be unquestionable. Very soon you will begin to have opportunities to better yourself, for the greatest need of the business community to-day is "honest and reliable young men." It is up-hill all the way, and the sooner you realize this fact the better, so that you may put your shoulder directly to the wheel, and do not cease pushing until you are perfectly satisfied with the position that you have attained. Hold all the ground you gain, and if you are capable of rapid advancement then go ahead. Cultivate a taste for reading, and invest your spare change in good books that pertain to your business, thus you will have an advantage over the ordinary mechanic, who, although he may be a good mechanic, is intellectually lazy.

(2) J. P. G., Marblehead, Mass., writes: I should like to ask, through your paper, what makes a lathe (in cutting threads) cut every other thread higher than the next, same as the diagram? [Note.—A sketch was enclosed showing a screw with every other thread high and low alternately, *i. e.*, one thick and one thinner.] *A.*—You should have given the number of threads that you were cutting, also number of threads on leading screw, as we could then form a more definite idea as to the cause. We have seen a similar effect caused by lost motion between the carriage and the shears. In another case the fault was in the threads of the leading screw, in another the screw was bent, and still another was caused by end play of the leading screw. This is one of those cases which require a personal inspection of the particular machine in which the fault occurs, when the cause may be readily detected. We have even seen the fault you name caused by simply grinding the thread tool wrong, or with no clearance.

(3) M. H. P., Walpole, Mass., asks: Is there any formula for obtaining the correct size of cone pulleys so that each speed will use the same length of belt, allowing the pulleys to be of equal size, or of different diameters? *A.*—Suppose the velocity of the upper or driving cone to be 100 revolutions per minute, the joint diameter of the two cones 20 inches and the velocities required on the different speeds to be 75, 150, 225, 300 revolutions per minute. Write down the velocities as required above, and under each write that of the upper cone, add them together and set the amounts under, as in addition, and make each amount the denominator of a fraction, of which the velocity of the upper or driving cone is the numerator. Multiply the joint diameter 20 by each of the fractions so found, and the products will be the several diameters of the pulleys upon the driving cone. The same operation, repeated with the velocities sought as denominators, will give the diameters of the driven cone. Example:

75	150	225	300
100	100	100	100
175	250	325	400

100÷175×20=11 3-7
100÷250×20=8
100÷325×20=6⅔
100÷400×20=5
75÷175×20=8 4-7 +11 3-7=20
150÷250×20=12+8=20
225÷325×20=13 11-13+6 2-13=20
300÷400×20=15+5=20

(4) M. A. B., Waterloo, Iowa, writes: I wish to make a foot-power wheel for a lathe by taking an iron wheel and casting on it a heavy rim of cement. What kind of cement do you think will answer the purpose? *A.*—We would not advise you to waste any time by experimenting with cement, but if you wish to add to the momentum of your wheel attach some flat plates of iron or lead to the inside of the rim by means of rivets or bolts. The proposition in reference to cutting screws, mentioned in your communication, is no new discovery.

(5) E. T. S., Sedalia, Mo., asks: What size larger than hole should saw mandrels of steel be for shrinkage of cast-iron collar? Diameter of holes in collars 1½", 1⅞", 2", and 2½", also for cranks, cast iron or wrought iron, diameter of shafts from 3" up to 10"? Answers to the above will be of great benefit to us young machinists. *A.*—We can give you no definite answers in figures to the above questions, for the size and shape of the collars, condition of the hole, the degree of hardness of the material, and the purpose to which it is to be adapted determines the amount to be allowed for shrinkage. We would, therefore, say that these, like many other operations in machine-shop manipulation, is seven-eighths common sense and good judgment. 2.—About gearing: I know that there are many books printed giving instructions how to calculate the shape of teeth and pitch of gearing. I have read not a few of them, but there is too much of the college style and algebra about them for the average educated mechanic. Please give us, at no distant day, a plain article for finding pitch circle, or line, how it is found, and at what point in the height of tooth it is located; also a correct plain rule for the calculation of the sizes, speeds, and bevels, also the angles of bevel gearing. From a large bevel gear how to match pinion for casting; also how to find the shape to make a mill cutter to cut any one shape of tooth. I have read of what is known as the Manchester rule, but have never seen it in print. Is it a correct one? *A.*—In our next issue will be found a very plain article on the teeth of gears, etc., by V. Hook. Instructions how to get the true, or chordial pitch of gears was given in answer to question 3, in our issue of December, 1878. The best available treatises on gearing, containing all the instructions that you may require, are viz.: "A Practical Treatise on the Teeth of Gear Wheels," by Prof. R. Willis; also a practical treatise on the same subject by Prof. S. W. Robinson These books are the plainest that we know of which you can easily understand. Any points that you do not understand can be explained to you by any school teacher or student.

Manufactures.

Joseph Wharton, of the American Nickel Company, having purchased the German patent, is erecting a building, 82×160 feet, on the east bank of Cooper's creek, Camden, N. J., for the purpose of rolling nickel plates, which has never been done in this country.

The rubber factory at Bloomingdale, N. J., is being extensively enlarged. Five hundred and forty-six hands are now employed, and by January first a thousand will be on the pay roll.

The miners at Brookfield, Ohio, have secured an advance of ten cents per ton.

The miners employed by C. H. Armstrong, at Buena Vista, Pa., have had an advance of two and one-half cents.

Texas is rapidly putting up cotton factories in order to utilize her superabundant cotton crops.

On Saturday, two weeks ago, the Bethlehem (Pa.) Iron Company paid out to its employees $65,000.

The Pennsylvania Railroad Company has contracted for 1,000 freight cars of twenty tons capacity each.

Four hundred locomotives are turned out by the Baldwin Locomotive Works, of Philadelphia, annually. This is more than one a day.

Many of Bridgeport's manufacturing concerns, including the cartridge and cutlery companies, are running late nights to fill orders.

The Portland (Me.) Company are building the machinery for five steamers, and have orders on hand for large amounts of boiler and tank work. They also have in hand six locomotives, one of which has just been sold to the Portland & Rochester Railroad.

The puddlers of the Susquehanna Rolling Mill Company, Columbia, Pa., have gained an advance of twenty-five cents a ton.

The N. Y., L. E. & W. R. R. elevator, New York, is nearly completed. The wages of this company's employees in the freight house have been raised from $1 to $1.25 per day, but the other companies are not following suit.

The Bangor Foundry and Machine Company, and Wood, Bishop & Co., of Bangor, have increased the wages of a portion of their help ten per cent.

James Tubbs, Cohoes, N. Y., is busy on orders for knitting mills and knitting machines, running until nine o'clock every night.

Campbell & Cluett, Cohoes, N. Y., have taken orders for fifty knitting machines within four weeks.

John Adt, New Haven, has just completed one of his improved automatic wire straightening and cutting machines (for one of the largest wire manufacturing concerns in the country, which also runs two other machines of the same kind), which, at testing, straightened ⅜ inch wire and cut it in lengths of sixteen (16) feet at the rate of six (6) per minute, the rate of speed being no higher than it would bear continuously, and not as high as some manufacturers would think it ought to run. He does not think this has ever been equaled in that line before.

The Portland Me., Rolling Mill, property has been bought by Mr. J. B. Brown for $71,000, cash. The purchase was made for a new company which is organizing.

The new owners of the Boston and Fairhaven Iron Works corporation in Fairhaven, Mass., have formed a new corporation for the general iron-founding and machine business, to be known as the Fairhaven Iron Works, and to have a capital of $16,000. They are manufacturing the Fairhaven printing press, and are getting out castings for Ingalls & Kendrick's (Boston) steam-heating apparatus, and other work, including water and steam motors.

The Waterbury, Conn., Button Company are about to make extensive alterations in their factory. The entire work is to be completed by November 12.

The Atlantic Car Works, at Salem, Mass., have been purchased by W. H. Thompson, treasurer of the Kearsarge Mills at Portsmouth. They are to be occupied by the Lowell Felting Company for the manufacture of felts. A large corporation in a different branch of business will also begin manufacturing in the larger of the buildings.

The moulders employed at Dennis Long & Co.'s Pipe Works, Louisville, Ky., about 100 in number, struck for an advance of 20 per cent on present wages.

Bishop & Gavitt have established an iron foundry in Attleborough, Mass., where they have a good water power and convenient railroad facilities.

J. C. French is building an addition to the South Worcester, Mass., Carpet Mill, 116 by 54 feet, to be used by the Pakachoag Manufacturing Company.

The Stower Iron Forges, at Ballston Spa, N. Y., recently purchased by R. J. Esmond, will begin operations December 1.

Bids are solicited by the City of Boston, until Dec. 5, for the following pumping engines for improved sewerage:

1st. For *Four* High-Duty Engines, from designs furnished by the City, with

2d. An Alternative price for only *Two* Engines from the same designs.

3d. For *Four* High-Duty Engines, with boilers, etc., complete, from designs furnished by the bidder, with

4th. An Alternative price for only *Two* Engines, with boilers, etc., complete from the same designs.

5th. For *Two* Low-Duty Storm Engines, with boilers, etc., complete from designs furnished by the bidder.

Inquiries should be addressed to Lucius Slade, Chairman Committee on improved Sewerage.

The Mayville, Ky., *Eagle* says the Hillsboro Shear Company, a new enterprise for the manufacture and sale of a combined shear and buttonhole cutter, is getting ready for business.

Philip Kreuscher, corner Broadway and Siegel St., Brooklyn, N. Y., is about to erect a new factory, 18.6×45 feet, two stories high.

The Freeland Tool Works, New York, are crowded with orders for machinery. They are now building a lot of machine tools for R. Hoe & Co., also a number of air compressors.

The "Brown" automatic cut-off engine, manufactured by C. H. Brown & Co., of Fitchburg, Mass., carried off first prize at the Cincinnati Exposition.

The Elgin (Ill.) National Watch Company are extending their works.

The Danford Car Axle Company, Chicago, with a capital of $1,000,000, was licensed to organize by the Secretary of State some days ago.

The Lehigh Car Manufacturing Company of Stemton, Northampton County, Pa., have closed a contract for eleven thousand cars, which will keep the works running at their full capacity for many months.

A company is in process of organization in Louisville, Ky., for the manufacture of crucible steel castings.

The Tonawanda, Pa., Axle Works have resumed operations.

A new shoe manufactory is to be erected at Beverly, Mass., by J. H. Baker.

The Millers Falls, Mass., Manufacturing Company are building another addition to their foundry.

C. F. North is building a new six-set knitting mill in the rear of his block on Mohawk street, at Cohoes, N. Y.

W. P. Ford & Co., of Concord, N. H., have voluntarily increased the wages of the men employed in their foundry ten per cent.

It is reported that $37,000 out of $50,000, to be raised by the citizens of Kittaning, Pa., toward the erection of the new rolling mill, has been raised.

The new boiler works of Frazer & Chalmer at Chicago are completed. Their new four story and basement manufactory and warerooms are nearing completion and will be ready for occupancy on or about Nov. 30.

"The American Watch Tool Co. was awarded, at the Industrial Exhibition recently held at Cincinnati, the highest prize, a silver medal, for their watchmaker's lathes and tools, and also a silver medal, likewise the highest, for their machinist's and model maker's lathes. The company, it will be remembered, was equally successful in obtaining the highest award at the last Mechanics' Fair in Boston.

"It is gratifying to know that, under the careful management of Mr. Ambrose Webster, the business of the company is constantly increasing, and that it is winning and maintaining an enviable reputation for doing first-class work, and making excellent tools; and, as an instance of this, it may be mentioned that they have recently filled a large contract for lathes and tools, given by the Elgin National Watch Company, to the entire satisfaction of the latter corporation."—*Waltham Weekly Record.*

Geo. Fox & Son, Boiler Works, 519 West 34th St. New York, are turning out a large amount of work. We noticed a few days ago, ready for shipment to a Cuban Sugar mill, a boiler 40×5½ feet. They are building two boilers 5×16 feet, two 4½×14 feet, one 15×5 feet, besides several smaller ones.

The Buckeye Engine Co., New York, have just received an order for a pair of 18″×36″ condensing engines from the Anniston Manufacturing Co., Anniston, Ala., also a pair of 22″×44″ engines for the York Mf'g Co., Saco, Me., also four engines for the new mills of the Jesup & Moore Paper Co., Wilmington, Del.

McLoughlin Bros., corner Third and South Eleventh St's Brooklyn, N. Y., are building an addition to their factory.

The contracts for the stone work, blast and puddling furnaces for the new rolling mill at Kittanning, Pa., have been awarded. The company expect to have the mill in operation before the first of February next.

A new brick foundry is being added to the Cobourg (Ont.) Car Works.

It is stated that an iron pipe mill is to be established at Beaver Falls, Pa., within a short time.

A new rolling mill is talked of at Chester, Pa., that will give employment to a large number of hands.

The Harlan & Hollingsworth Co., Wilmington, Del., are extending their plant by the erection of a new boiler shop and a new machine shop.

Edward P. Allis & Co., of Milwaukee, have shipped two car-loads of machinery a day for the past 60 days. They are running night and day with a force of 700 men, and have now orders for 23 engines, besides their large milling contracts.

The Nimson Forge & Axle Works at Allentown, Pa., has been purchased by E. P. Bullard, 14 Dey St., N. Y.

A new hat factory is building at Reading, Pa.

The Phoenix Iron Co., Phoenixville, Pa., refused the puddlers in their Nonesuch mill an advance in wages, and a strike was the result.

Application has been made for a charter to incorporate the Manchester Iron & Steel Co. of Pittsburgh, Pa. They are to lease the old Superior rail mill and furnace, and make considerable enlargements. The incorporators are prominent iron men.

The St. Louis shoemakers (hand-sewers) have obtained an advance of 15 per cent.

The people of California, Washington county, Pa., offer to give land for manufacturing sites and liberal money aid to such industries as may locate in that place.

Machinists' and Engineers' Supplies.

NEW YORK, October 30th, 1879.

Trade moves blithely and manufacturers and supply dealers seem to be happy. The Henry Disston & Son File Co. have advanced their prices on files to 25% discount. Tin, brass, and zinc oilers have been slightly advanced. Sheet brass is selling at 10% discount from list, with no prospect of an early advance.

Holiday goods are making their appearance in the trade. The Holly Scroll Saw and the Improved Demas Lathe are among the most popular new tools offered. Peter A. Frasse & Co., 95 Fulton street, New York, have just received a full stock of both these tools. The scroll saw is all iron, has a solid emery wheel, improved clamps, swings 20 inches, and is neatly painted in ultramarine blue, decorated in gold and silver. It sells for $3, with 20 new process designs, 6 extra blades, and one manual of fret sawing. The Demas Lathe has a scroll saw attachment, solid emery wheel, and a variety of tools; the whole being sold at $8.

Morgan & Herrick, 86 John street, New York, have just issued the following price-list of the Vulcan Patent Forge: No. 1, weight, 140 lbs., $28; No. 3, weight, 190 lbs., $35. This price includes the Hood for No. 3. In case no Hood is required a reduction of $3 from above list is made. Vulcan Hand Blower.—No. 1, $20. This price includes improved Tweer iron.

The John Ashcroft Mfg. Co. have just opened a warehouse and office at 40 John street, New York. They manufacture Ashcroft's Patent Boiler Door, Grate Bar, Low Water Alarm, and Steam Cooking Apparatus.

The Hendey Machine Co., Wolcottville, Conn., write us as follows: "Owing to great advance in price of labor and material, present quotations of prices of our tools will be cancelled on and after Nov. 10th, 1879."

Iron Review.

NEW YORK, Oct. 30th, 1879.

There is no falling off in the demand and no weakening of prices. There has been no advance since our last issue, and during the remainder of this year prices are not likely to keep advancing as rapidly as they have for the last two months.

Pierson & Co., 24 Broadway, New York, quote prices, out of store, as follows:

No. IX Pig Iron, $31 per ton; Iron Rails, $46 to $55, according to weight; Old Rails, $31.50 to $32; Fish Plates, 3c. per lb.; Railway Spikes, 3½c.; Bolts and Nuts, 4½c.; Common Bar Iron, 3c., basis from store; Refined, 3 2-10c., basis; Ulster, 3 8-10c., basis; Machinery Steel, 7c.; Best Tool Steel, 12½c.; Norway Bar Iron, 5½c.; Norway Shapes, 6c.; Nail Rods, 6 to 6½c.; Sheet Iron, 4½c., basis; Angle Iron, 4c., Tee Iron, 4½c.; Band Iron, 3 6-10; Hoop Iron, 3 8-10c.; Horse Shoe Iron, 3 8-10c.; Tank Iron, 4½c.; C No. 1 Boiler Plate, 4¾c.; C. H. No. 1 ditto, 5c.; Best Flange ditto, 6c.; Boiler Rivets, 5c. to 6¼c.; Hot Polished Shafting in lengths, 2 ft. and longer, 7 to 8c., according to size; Small Black Rivets, 50% off in papers, 35% off in bulk.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling slip, New York, furnish us the following, under date of Oct. 30th, 1879:

Business in metals for the past week has been principally confined to jobbing trade. Pig Tin is still in small stocks on spot; prices well maintained, on the lower basis. Offers accepted for future at lower figures. Pig Lead dull with an easier market. Antimony will continue in light supply; no shipments from England until December. We quote as to-day's ruling figures: Banca Tin, 27c.; Malacca and Straits, 24c.; Australian, 23½c.@24c.; "Lamb & Flag," 22½c.; Bar, or Strip Tin, 24c.; London, £90 ℔ ton; Singapore, $26½ ℔ picul; Pig Lead, 5c.@5¼c., as to lots. Antimony, Hallett's, 18c.; Cookson's, 19c.; Western Spelter, 6½c.@6½c.; Foreign, 6½c.@6¾c.; Ingot Copper, 21½c.@22c.; Nickel, $1.50; Bismuth, $2.50; Solder, No. 1, 12½c.; Half-and-half, 14½c.@15c.

Situations Wanted—Help Wanted.

We will publish notices suitable for the above headings, applying to any of the machinery trades, and not to exceed four lines each (32 words), at the nominal rate of twenty-five cents for each insertion.

WANTED.
FOUNDRY FOREMAN.

Present force sixty to seventy men. Machine Castings only are made. Business well established. Healthy location and living cheap.

A competent man can secure a permanent situation. Reference required.

Address FOUNDRY,
Care American Machinist, New York City.

A practical draughtsman, experienced in designing machinery for special purposes, desires a situation. Can furnish good recommendations. Address D. L. F., office of AMERICAN MACHINIST, 96 Fulton st., N. Y.

As master mechanic of a small railroad. Have had nine years experience and have excellent references. Address Railroader, Box 381, Norwalk, Fairfield Co., Conn.

Situation wanted to learn the Machinist's Trade. Am willing to work and can furnish good recommendations. Address, James Dougherty, 342 East 60th Street, New York City.

A situation by a Pattern Maker. Has had 15 years experience; has been foreman of pattern shop for the last 5 years; has had some experience in mechanical drawing. Address Pattern Maker, American Machinist, 96 Fulton Street, New York.

USEFUL BOOKS
FOR
PRACTICAL MEN.
DESCRIPTIVE CATALOGUE FREE.
E. & F. N. SPON, 446 Broome Street, N. Y.

Drawing Instruments
AND MATERIALS, PAPER, &C.
G. S. WOOLMAN,
116 Fulton Street, New York.
Fully priced and illustrated Catalogues.

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EXMUTIL TRADE TANITE MARK UTILITAS
Machinists' Supplies,
CHAMPLIN & SPENCER,
154 E. Lake Street,
CHICAGO,
Sole Agents for the Tanite Co.'s Solid Emery Wheels, Grinding Machinery, &c.
Also, agents for **Shepard's Screw Cutting Lathes** Dealers in Morse Twist Drill Co's Goods and small tools for all workers in iron or wood. Send for Catalogue.

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Machinists' Tools, Drills, and Taps and Dies. Also, **Belting and Steam Packing** of all kinds, and a general assortment of supplies for
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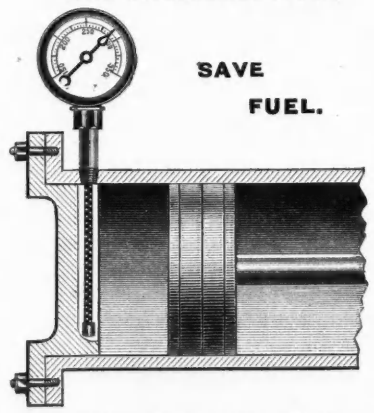
No. 12 South Fourth Street,
PHILADELPHIA, PA.

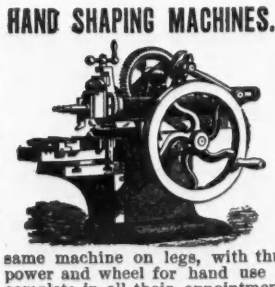
MODEL WORK-SEAL PRESSES.
STEEL NAME STAMPS.
W.W. OLIVER BUFFALO, N.Y.

STEAM ENGINE ECONOMY.
The DIXWELL IMPROVEMENTS
FOR WORKING ENGINES
WITH SUPERHEATED STEAM.



APPLICABLE TO ANY ENGINE.
GEO. H. BARRUS, Agent,
Office, 553 Shawmut Avenue, - BOSTON.
On exhibition at the American Institute Fair with the Buckeye Engine. Estimates furnished on application. Address, during the Fair, 206 West 53d Street, New York.

Boynton & Plummer,
WORCESTER, Mass.
Manufacturers of
HAND SHAPING MACHINES.



These machines have a stroke of six inches and may be readily adjusted to work any less distance. Length of traverse eight inches. Vertical adjustment of table five inches. The surface of hand wheel is made flat so as to carry a belt when wanted for power. The same machine on legs, with three speed cones for power and wheel for hand use also, making them complete in all their appointments, and a desirable tool for Model Makers, Die Sinkers, Railroad Shops and all other shops where machine work is done.

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SOLE MANUFACTURERS OF

FILES AND RASPS

HAVING THE INCREMENT-CUT.

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"Nicholson File Co's" Files and Rasps.
"Double Ender" Saw Files. File Brushes, File Cards.
"Slim" Saw Files. Surface File Holders,
"Racer" Horse Rasps. Vise File Holders.
Handled Rifflers. Stub Files and Holders.
Machinists' Scrapers. Improved Butchers' Steels.

Manufactory and Offices at **PROVIDENCE, R. I., U. S. A.**

C. W. LeCOUNT,

South Norwalk, Connecticut.

Manufacturer of

LeCount's Patent Hollow Lathe Dog or Carrier,

OF MALLEABLE IRON.

They are thin so that the tool can be used close to the centre; strong and light; they are of a shape to hold; the screws are hardened in a way that they are not easily broken; they are perfect fits with full thread in the box.

No. 1,	⅜	inch	$ 45
" 2,	½	"	45
" 3,	¾	"	60
" 4,	1	"	70
" 5,	1¼	"	90
" 6,	1½	"	1 00
" 7,	1¾	"	1 20
" 8,	2,	"	1 40
			$6 70

Price for a set of 8 small sizes, from ⅜ to 2 inches, inclusive, $6.50.

No. 9,	2½	inch	$1 75
" 10,	3	"	2 00
" 11,	3½	"	2 40
" 12,	4,	"	2 70

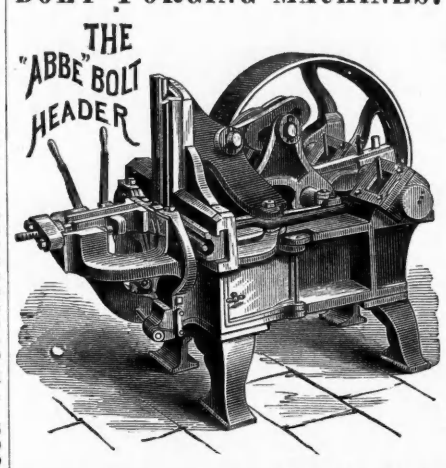
Price of four large sizes, inclusive.....$8 85

A full set of 12 Dogs, from ⅜ to 4 inches, inclusive.....$15 00

5 inch Dog..... 4 00
6 " " 5 00
¼ inch Dog.....45 cts.

SEND FOR DESCRIPTIVE CIRCULAR.

BOLT FORGING MACHINES.



Power Hammers, Machinists', Blacksmiths' Tools and Wood-Working Machinery a Specialty.

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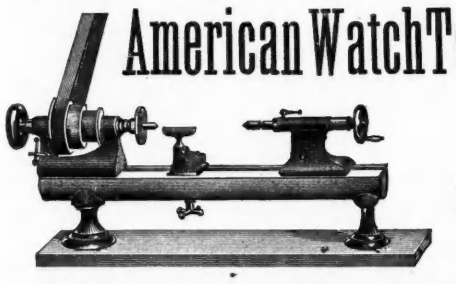

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Watch and Clock Making,

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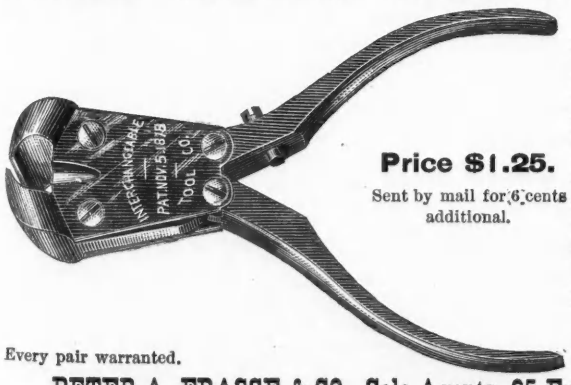
Special Tools and Machinery of all kinds.

The accompanying cut shows our No. 3, or Machinist Bench Lathe. This lathe was originally designed for the American Watch Co., and has been adopted by all American watch companies and by many clock companies of this country, and watch companies of England and Switzerland. All agree in pronouncing it the best lathe for small work ever made.

HALL'S PATENT

DOUBLE COMPOUND LEVER CUTTING NIPPERS.



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Sent by mail for 6 cents additional.

Of the many Cutting Nippers heretofore placed on the market, not one has supplied either of the two great needs long felt by all who use them, viz.: 1st. Increased power without a clumsy and expensive increase of size. 2d. That the construction of the Nipper should be such that any damage to the cutting jaw or handle, from wear or accident, could be repaired.

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Every pair warranted.

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With Quick Return Motion.

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Please state where you saw this Advertisement.

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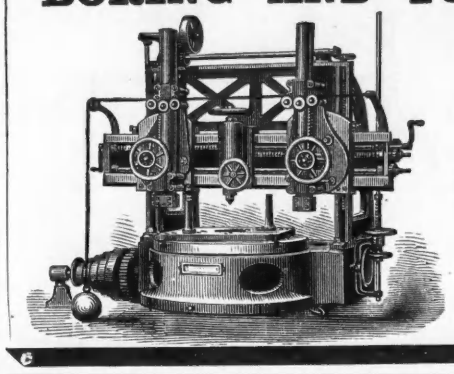

All Sizes: 4, 5, 6, 8, 10, and 12 feet Swings.

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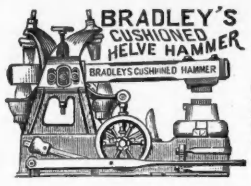

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Being the highest award given any goods of their class in America or Europe.

IT HAS MORE GOOD POINTS, LESS COMPLICATION,
MORE ADAPTABILITY, LARGER CAPACITY,
DOES MORE AND BETTER WORK, TAKES LESS POWER,
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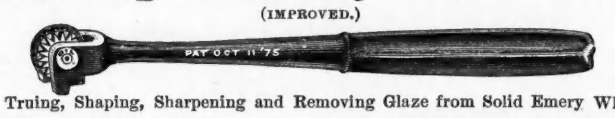
(IMPROVED.)

Invaluable to Users of Emery Wheels.



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☞ *Estimates promptly furnished large buyers personally or by mail.*

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BUILDERS OF

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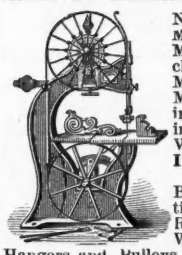

Numbering some 300 different Machines—Planing and Matching Machines, Surface Planing Machines, Molding and Tenoning Machines, Mortising and Boring Machines, Carving and Dovetailing Machines, Shafting and Friezing Machines, Horizontal and Vertical Boring Machines.

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This is the only exclusively **TOOL STORE** in Philadelphia. We now have a reduced price in Machine Screws. All kinds of Carvers and Gravers.

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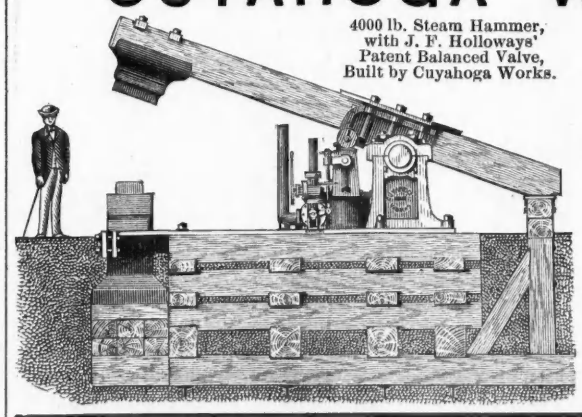

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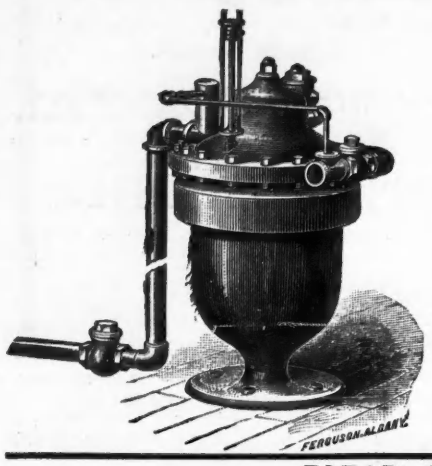

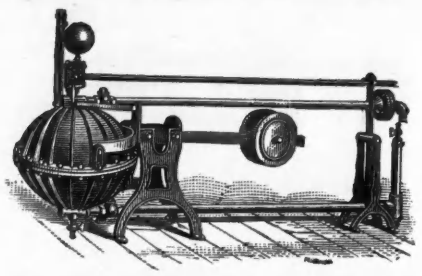

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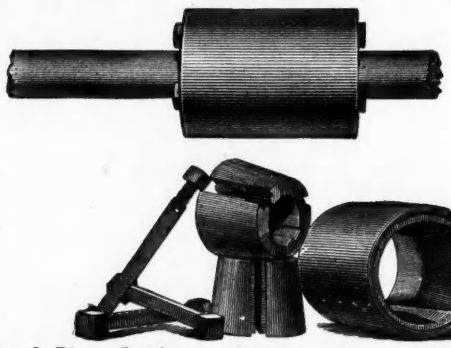

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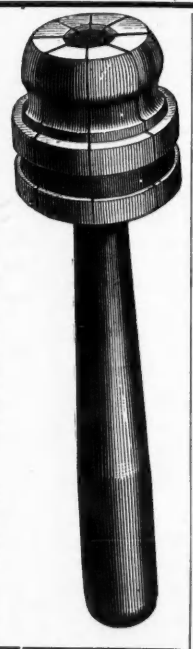
STEEL SCREW PUNCHES, TUBE BRUSHES, &C.



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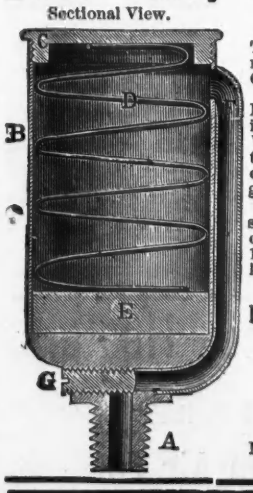

The only reliable automatic Loose Pulley Oiler in the World.

Saves Oil, Belting, Machinery, Time, soiling of Fabrics, &c., &c. Will run from one to three months with once filling. Gives general satisfaction.

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Spiral Shearing Punch.

THE

DRILL

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SUPERSEDED,

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2½ TONS PER SQUARE INCH

STRONGER than with the FLAT PUNCH.

Can be used in any Punching Machine, by license from the patentee.

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Automatic Machines,

For Straightening and Cutting Wire of all Sizes to any Length.

Automatic Machines for cutting and forming wire in various shapes. Send for circulars.

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FOOT POWER LATHES A SPECIALTY.

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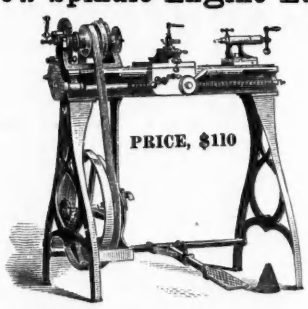
IMPROVED

Hollow Spindle Engine Lathe.



Length of Bed, 42 in. Swing, 11 in. Turns 22 in. between centers. Three Cone Spindles and Wheels. Weight 450 lbs.

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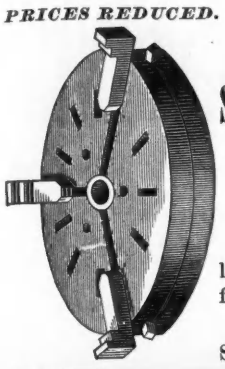

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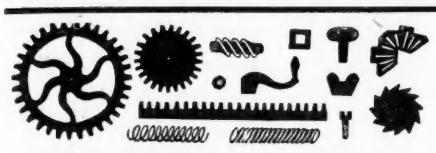

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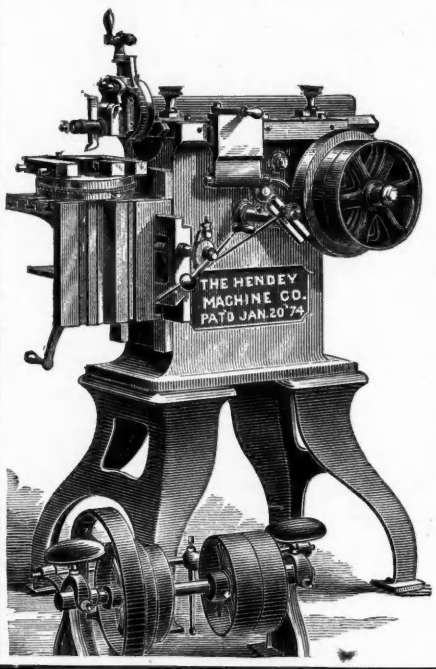

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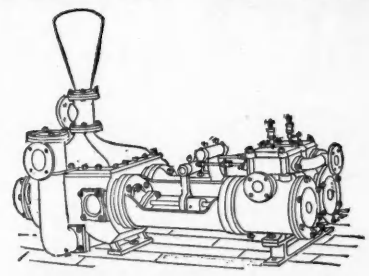

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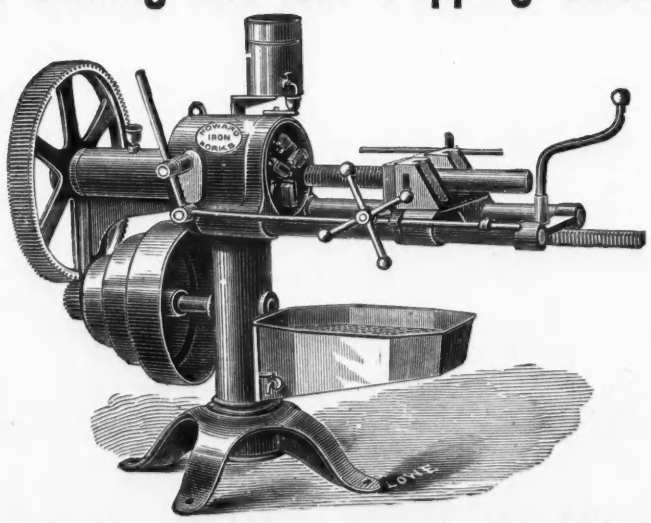

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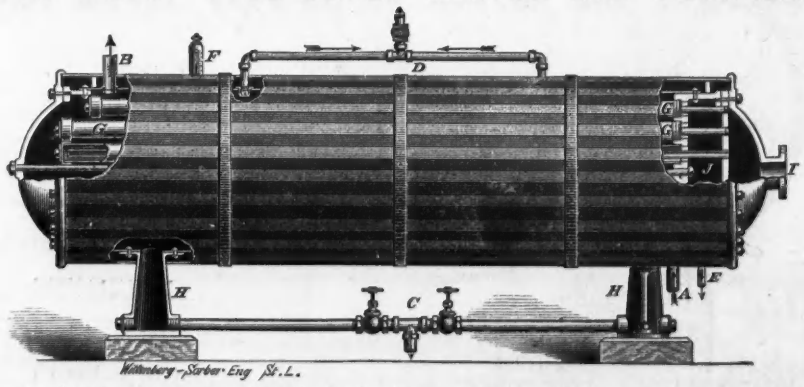

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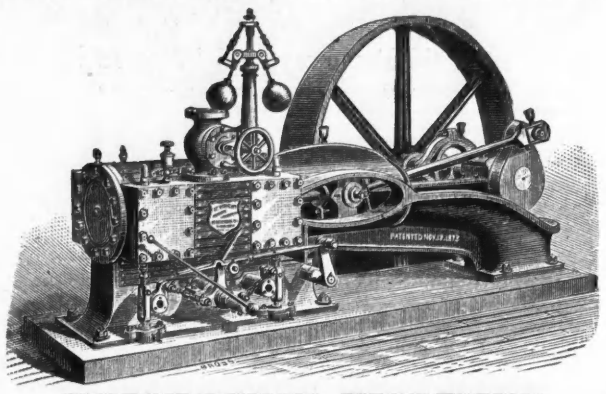

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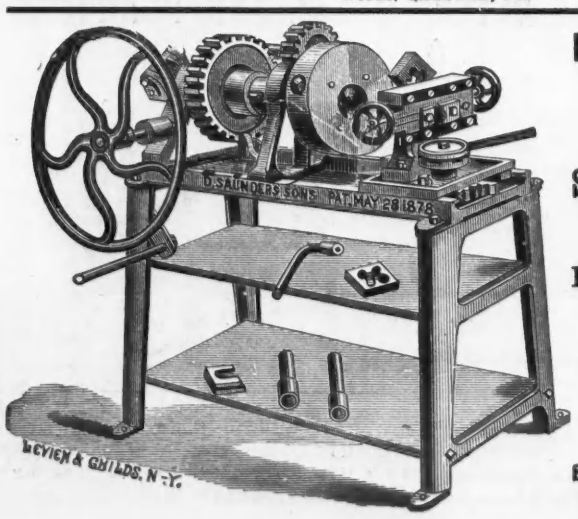

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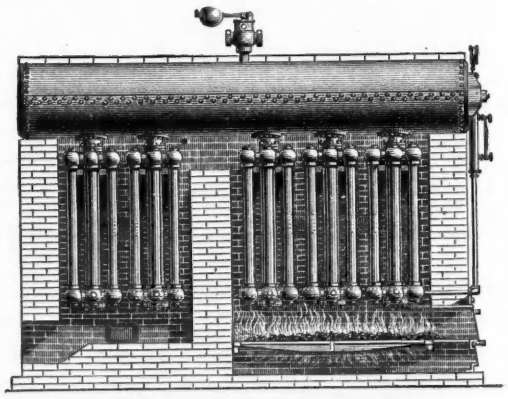

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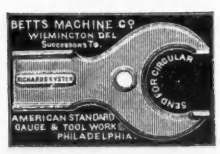

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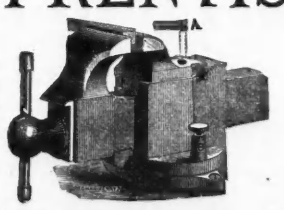

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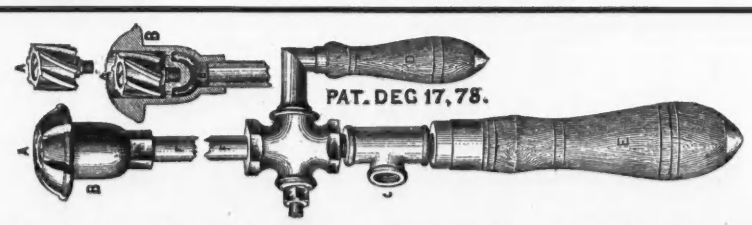

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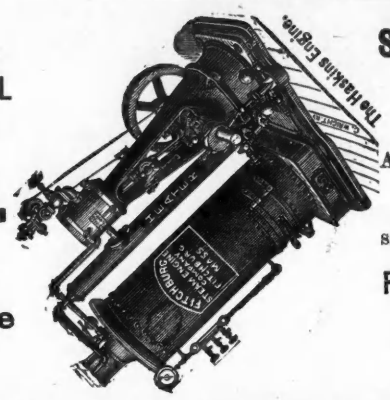

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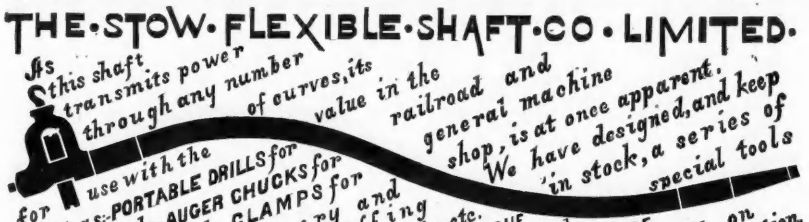
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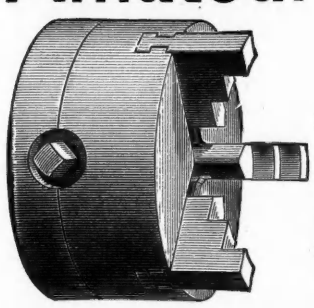

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Judson's Governors, from 2 in. to 2½ in.

MACHINISTS' TOOLS.

One Lathe, 28 in x20 ft.
One " 24 in.x14 ft.
One " 16 in.x7 ft.
One " 22 in.x8 ft.
One " 40 in.x28 ft.
One Pattern Maker's Lathe.
One Planer, 42 in.x42 in.x16 ft.
One " 42 in.x42 in.x9 ft. (Pond, maker).
One " 30 in.x30 in.x7 ft.
One " 27 in.x24 in.x6 ft. (Pond, maker).
One " 27 in.x22 in.x4 ft.
One Shaper, 12 in. stroke.
One " Stover's make.
One Slotting Machine, 36 in. stroke, 7 ft. wide.
One " " 12 in. stroke, 30 in. wide.
One Bement & Son's Boring Machine.
One Travis' Boring Machine.
One Milling Machine.
Eighteen Drilling Machines.
One Root Blower.
Dudgeon's Punches and Jacks.
One Bogardus Mill. No. 5.
" " " " 2.
" Pair Hand Shears.
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One Large Power Punch for bridge iron.
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One " " 26 in. x 13 ft., very heavy.
One " " 22 in. x 21 ft., for shafting, Wh'ler.
One " " 20 in. x 12 ft. Johnson's.
Three " " 20 in. x 8¼ ft. Wood, Light & Co.
Three " " 20 in. x 6 ft. Wheeler.
One " " 19 in. x 7 ft. Whitcomb.
One " " 18 in. by 10 ft. Wheeler.
One " " 18 in. x 8¼ ft. Wood, Light & Co.
Three " " 18 in. x 7 ft. N. Y. S. Eng. Co.
One " " 16 in. x 8 ft. Wheeler, new.
Two " " 16 in. x 7 ft.
One " " 16 in. x 6 ft. Wheeler.
Three " " 15 in. x 6 ft. Lathe & Morse.
One " " 14 in. x 5 ft. Wheeler.
One " " 13 in. x 5 ft. Gould.
One " " 24 in. x12 ft Not Screw Cutting.
One " " 16 in. x 10 ft. Not Screw Cutting.
One large Chucking Lathe and Chuck.
Two Hand Lathes, 18 in. x 4½ ft.
One " " 15 in; x 8 ft. Pratt & Whitney.
One " " 13 in. x 5 ft.
Six " " 11 in. x 4½ ft. New Spencer.
Six " " 7 in. x 2½ ft. " "
One Planer, 48 in. x 48 in. x 12 ft. Good order. Plass.
One " 31 in. x 31 in. x 7 ft. New. Stover.
One " 30 in. x 30 in. x 8 ft. Whitcomb.
One " 30 in. x 30 in. x 7 ft.
One " 30 in. x 30 in. x 6 ft. Wheeler.
One " 24 in. x 24 in. x 4 ft. W. L. & Co.
Two " 22 in. x 22 in. x 4 ft. Wheeler.
One " 22 in. x 22 in. x 5 ft. " New.
One " 20x20x6. Pratt & Whitney.
One Crank Planer, 24 in. stroke.
One 8 in. stroke Shaper. Gould.
One 8 in. " " Pratt & Whitney.
One 24 in. " " Hendey Machine Co.
One Brown & Sharp Universal Milling Machine.
One No. 3 Garvin Milling Machine.
Three Lincoln Pattern Milling Machines.
One Whiton 22 in. Gear Cutter.
One Pond's Index Millers.
One 21 in. Swing Upright Drill. Wheeler.
One Suspension Drill. Bk. Geared, Self-Feed. Pond.
One each No. 0 P. and W. 2 and 3 Spindle Drills.
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Three Sensitive Drills, drills to 3-16 in. hole.
One Pratt & Whitney 2-Spindle Profiling Machines.
One Brown & Sharpe Tapping Machine.
One No. 3 Pratt & Whitney Screw Machine. Plain.
One No. 1 Brown & Sharpe " " Chasing Bar.
One No. 2 " " " "
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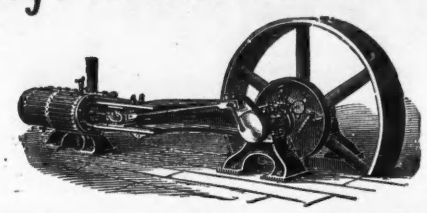

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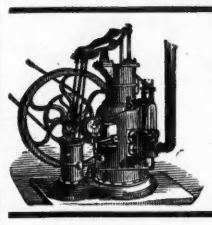

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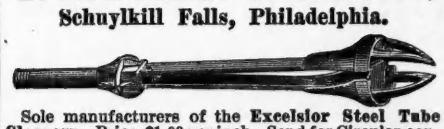

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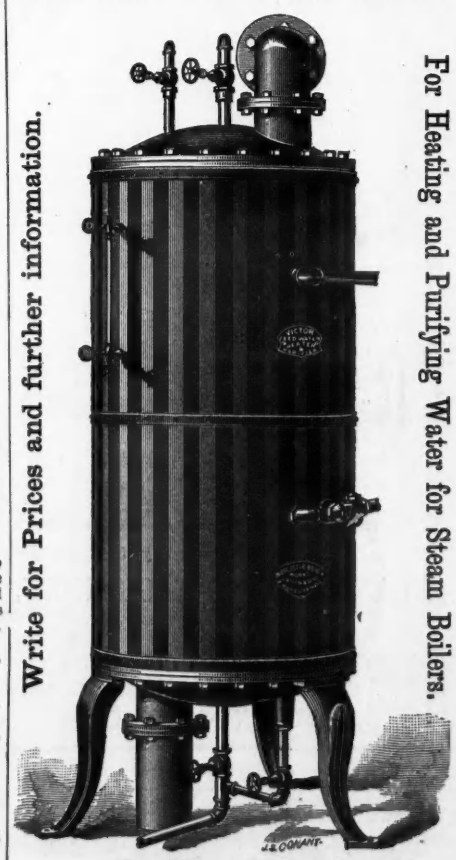

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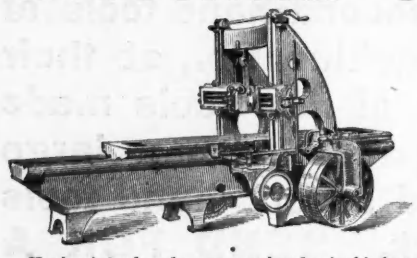

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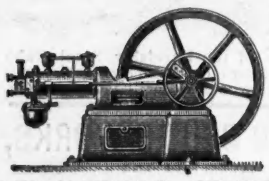

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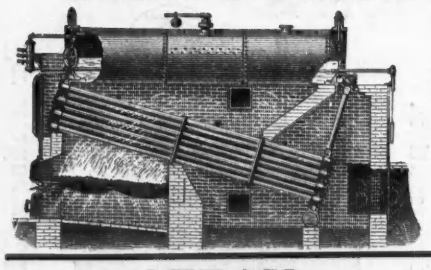

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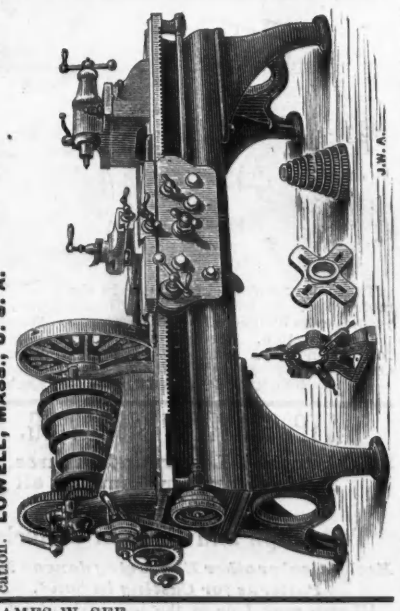

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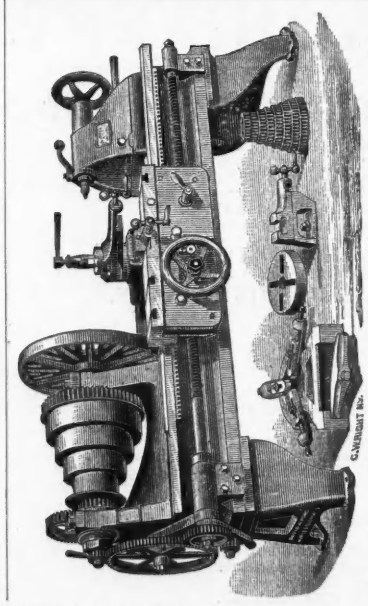

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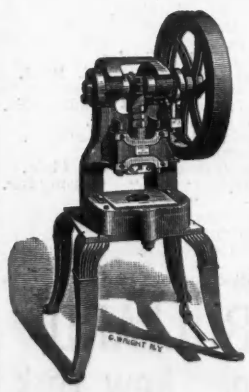

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